

# GROUNDWATER MANAGEMENT PLAN

JAMES IRRIGATION DISTRICT  
AND THE CITY OF SAN JOAQUIN

NOVEMBER 2010

PREPARED BY:



DATE SIGNED: 11-1-10

# **Groundwater Management Plan**

## **James Irrigation District and the City of San Joaquin**

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### **List of Abbreviations**

AB	Assembly Bill
ACWA	Association of California Water Agencies
AF	Acre-feet
AWMC	Agricultural Water Management Council
bgs	below ground surface
BMO	Basin Management Objective
CVP	Central Valley Project
DBCP	dibromochloropropane
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EC	Electrical Conductivity
EPA	Environmental Protection Agency
ET	evapotranspiration
EWMP	Efficient Water Management Practices
FKC	Friant-Kern Canal
FWA	Friant Water Authority
FWUA	Friant Water Users Authority
GAC	Groundwater Advisory Committee
GMP	Groundwater Management Plan
GPS	Global Positioning System
HSA	Hydrologic Study Area
ID	Irrigation District
IRWMP	Integrated Regional Water Management Plan
JID	James Irrigation District
KRCD	Kings River Conservation District
KRWA	Kings River Water Association
MOU	Memorandum of Understanding
MVWD	Mid Valley Water District
NRCS	Natural Resources Conservation Service
RCWD	Raisin City Water District
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SCIC	Stinson Canal and Irrigation Company
SCS	Soil Conservation Service
SLDMWA	San Luis and Delta-Mendota Water Authority
TDS	total dissolved solids
TID	Tranquillity Irrigation District
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WHPA	Wellhead Protection Area
WWD	Westlands Water District

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### **1 - INTRODUCTION**

This Groundwater Management Plan (GMP or Plan) is a joint effort between the City of San Joaquin (San Joaquin or City) and the James Irrigation District (JID or District). The two agencies are preparing this integrated GMP to better coordinate efforts, share data, and improve regional management of groundwater resources. Hereafter, the two agencies will be called the 'Plan Participants' and the area covered by the GMP will be called the 'Plan Area'. This Plan is the first effort by the City of San Joaquin to develop a GMP. This Plan is also an update to JID's GMP prepared in 2001, and this GMP satisfies new requirements for GMPs created by the September 2002 California State Senate Bill No. 1938, which amended Sections 10753 and 10795 of the California Water Code. This Plan also addresses recommended components for a Groundwater Management Plan described in Appendix C of Department of Water Resources Bulletin 118 (2003 Update).

#### **1.1 - Background Information on Plan Participants**

Following is general information on the Plan Area, followed by specific information on the City of San Joaquin and James Irrigation District.

##### **Climate**

The climate in the Plan Area is characterized by cool, mild winters and hot dry summers. Temperatures in the summer often exceed 100 degrees F. Fog occurs for long periods in the winter, with low temperatures typically in the mid 30's F; occasionally dropping into the 20's F. Average annual precipitation is about 7 inches, with 80 percent of the rainfall occurring from December through April. Precipitation is inadequate to meet crop water needs, except during the rainy season for some crops. Crops are sustained by irrigation during the summer. The growing season is typically 250 days per year.

##### **Topography**

Land in the Plan Area is relatively flat. It generally slopes westward and northward at a rate of about 3 to 4 feet per mile towards the topographic axis of the San Joaquin Valley, with local variations caused by remnants of slough channels. Elevations range from 160 to 180 feet above sea level.

##### **City of San Joaquin**

Below is a summary of the geography, demographics, water demands and water facilities in the City of San Joaquin.

##### **Geography and Demographics**

The City of San Joaquin was founded in 1920. The City is located in Western Fresno County about 11 miles southwest of the City of Kerman (see **Figure 1**). The City is an enclave in James Irrigation District. The City currently covers approximately 1 square mile. In 2010, the City had a population of 4,166. The population growth is expected to

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be 2.6% per year for the next ten years. Most of the population is employed in the agricultural industry.

Currently, rural dwellings in JID are not commonly being built. Old houses are being torn down and people are moving to San Joaquin or other urban areas. This could lead to more growth in San Joaquin. San Joaquin plans to expand to the east with an area of about one square mile. Specifically, San Joaquin expects to see the construction of about 300 new homes in the next five years.

#### Water Demand

Water usage in San Joaquin from 2005 to 2009 is summarized in Table 1.1.

**Table 1.1 – City of San Joaquin Water Usage**

Year	Volume	
	Million gallons	Acre-feet
2005	222	681
2006	221	678
2007	242	742
2008	259	795
2009	257	789

In 2008, the City's per capita water usage was 181 gallons per capita per day (gpcpd), which is close to the national average (ConSol 2009). About 60% of the water is used for outdoor landscaping. Fluctuations in gpcpd from year to year can be explained by a variety of economic, demographic, and climate factors. The per capita water use is not expected to increase, but may reduce with the implementation of conservation measures.

#### Facilities

The City is serviced by three groundwater wells. Combined, these wells have a maximum capacity of 3,500 gallons per minute (gpm) and 5 million gallons per day (gpd). In 2008, 49% (1,723 gpm) of the maximum groundwater well capacity was used during peak consumption for the City. The City hopes to construct one well in the near future to replace one of the older existing wells. The City does not use or import any surface water. The City also operates three stormwater basins that provide stormwater retention and incidental groundwater recharge. The City has no recharge basins or reservoirs, but has plans to construct a reservoir tank within the next few years.

Based on current analysis, the City is not expected to outstrip its supply capacity or lose ability to meet peak demands over the next ten years, unless one of the wells ceases to operate. This is a concern for the City since some of their wells are old.

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The City has about 950 service accounts. Residential accounts are not metered. About 5 percent of the accounts are commercial, and about 20% of the commercial accounts are metered.

### James Irrigation District

Below is a brief description of the origin, physiography, geology, water supplies and facilities in JID.

#### Location

The James Irrigation District (JID or District) was organized in 1920 under the California Water Code. The District covers 26,392 acres wholly within Fresno County, California. The San Joaquin Valley Farmlands Company, successor to the James Ranch, granted to JID a perpetual right to pump and import groundwater from beneath lands east of the District, up to 200 cfs in capacity. This GMP covers the area within the JID boundaries and deeded groundwater area, but the physiography and geology of neighboring lands are also discussed. The District is situated in the central San Joaquin Valley of California and is approximately thirty miles southwest of the City of Fresno. The City of San Joaquin lies near the middle of the District, but is excluded from the District's boundary. State Highways 145, 180 and 33 are in close proximity. Adjacent agricultural water agencies include the Tranquility Irrigation District (TID), Westlands Water District (WWD), Stinson Canal and Irrigation Company (SCIC), Mid Valley Water District (MVWD), Reclamation District 1606, and the Raisin City Water District (RCWD). A location map for the District is included as **Figure 1**, and a vicinity map of the District within the Kings Groundwater Basin is included as **Figure 2**.

#### Land Use

When JID was formed in 1920, agricultural development of its lands was well underway. As irrigation facilities were constructed, use of the land gradually converted from grasslands to cultivated crop land. District lands are now essentially fully developed for agriculture. Cropping data for 1993 to 2007 is included on **Attachment 1**. Typically, about 23,000 acres are irrigated and prevalent crops include cotton, wine grapes, corn, almonds and seed alfalfa. Other significant crops include tomatoes, sugar beets, wheat, and onions. Currently, the principal irrigation method is furrow irrigation, with smaller amounts of drip, level basin, and micro-sprinkler irrigation. There is a trend towards planting permanent crops and converting to modern irrigation methods.

#### Facilities

**Figure 3** is a map illustrating the major facilities in the District. JID's conveyance system consists of three major components: Eastside Canals, the Main Canal, and the Lateral Canals. The Eastside Canals consist of two canals, the Kerman Line Pump Canal (a.k.a. Lassen Canal) and the Coalinga Line Pump Canal (a.k.a. McMullin Grade Canal). These canals collect and convey groundwater pumped from about 35 JID wells, which lie outside of the District's boundaries, into the district. The Eastside Canals merge together and connect near the south end of the Main Canal by flowing through twin 60-inch diameter reinforced concrete pipelines that cross under the Fresno Slough



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Bypass (also called the James Bypass). These 60-inch pipelines are called 'the siphon'. In 1992, 3.25 miles of the Eastside Canals were piped with smooth interior corrugated polyethylene pipe, and the remaining 12.25 miles were concrete lined; the pipeline and canal lining were financed through a DWR sponsored loan and JID bonds.

The JID Main Canal operates as a lift canal for surface water that is pumped from the Mendota Pool. Groundwater and diverted Kings River flood releases feed by gravity into the Main Canal from the south and flow northwesterly. The system also includes 17 lateral canals that are mostly unlined earthen ditches.

The District also has about 63 groundwater extraction wells and about 20 monitoring wells. A summary of well attributes is provided as **Attachment 2**. In 2004, JID completed construction of the 220-acre K-Basin Recharge Project. The project includes six wells to recover some of the recharged water.

The proposed JID Water Augmentation Project will include new facilities for storing and recharging water, with the goal of reducing JID's dependence on surface water. The project will include improvements to basins and construction of new recovery wells and conveyance facilities. The project will provide facilities for regulation storage, floodwater storage, groundwater recharge, and groundwater banking. These facilities will be located just north of the James Weir in the Fresno Slough Bypass, about 3 miles southeast of the City of San Joaquin. It is estimated that the project will allow JID to capture and recharge an average of 4,740 AF/year of Kings River floodwater. Five recovery wells will have the capacity to extract 30 AF/day. Other details on the project are not provided as the design continues to evolve. The project is currently being permitted and designed, and construction is expected to be completed by the end of 2011 or possibly 2012.

JID has also prepared a Water Banking Prospectus for the Water Augmentation Project. JID is actively seeking an agency that wants to bank water in JID using the proposed facilities. As a condition of any banking agreement at least 10% of the banked water must be left behind. This will contribute to local recharge and higher groundwater levels while the water is banked. The volume of water that will be banked still has to be negotiated with a potential banking partner.

#### Groundwater Supplies

The District owns and operates about 63 irrigation wells. The well locations are shown on **Figure 3**. About 28 of these are within the District boundary and about 35 are east of the District boundary within their deeded groundwater easement area. The current estimated yield for each well is shown on **Attachment 2**. Well yields range from 950 to 3,400 gpm, with an average of about 1,500 gpm. The total well pumping capacity is about 210 cfs. Most of JID's wells are between 500 and 600 feet deep, and extend to the top of the Corcoran Clay (a local confined aquifer). A few of JID's older wells are 700 to 900 feet deep and penetrate the confined aquifer. Two privately owned irrigation wells are inside of JID's boundary.

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An enormous aquifer system lies beneath the Kings Groundwater Sub-basin and extends the length and breadth of the San Joaquin Valley. The valley is a broad structural trough, with the Sierra Nevada mountains on the east and the Coast Range mountains on the west. The Sierra basement rock extends from the foothills on the east, sloping downward to the southwest at 4° - 6°. Consolidated and unconsolidated continental and marine deposits from both the Sierra and the Coast Range mountains overlie this basement complex. Unconsolidated alluvial deposits make up most of the basin's freshwater aquifer (Croft, 1972).

Interspersed within the unconsolidated deposits that comprise the usable aquifer in the region are a number of clay layers that can act as confining beds. The confining bed that has greatest significance to the District is known as the Corcoran Clay, or E-clay. The E-clay underlies the entire District. Two other clay layers also partially underlie the District.

JID now primarily uses the unconfined aquifer lying above the E-clay. The top of this clay occurs at a depth of around 500 feet below ground level within the District. Originally, most District wells constructed in the 1910's and 20's tapped the aquifer below the E-clay. Many of these wells initially exhibited artesian flow.

#### Surface Water Supply

CVP Schedule 2 water (informally called 'Riparian water') is delivered without charge as a settlement of the District's water rights claims in Fresno Slough – during normal and wet years 9,700 acre-feet is available, during dry years 7,600 acre-feet is available. The contract requires that the District take delivery of this water according to a predetermined schedule. In practice, the United States Bureau of Reclamation has allowed some flexibility on when this water is taken.

In addition, JID has a Central Valley Project (CVP) contract (No. 14-06-200-700L) for up to 35,300 acre-feet of water each year. Other water used by the District includes spillwater from the Fresno Irrigation District and Kings River floodwater.

In the past during wet years the USBR has made surplus water available to JID, which is above its normal contract deliveries. The source of this water may be either imports from the Delta via the Delta Mendota Canal, or San Joaquin River flood releases (called Section 215 water by the USBR).

#### Water Demands

Water demand in the District slowly increased over the years as land was brought into production. Since full agricultural development has now occurred, change in demand is largely the result of changing cropping patterns. **Attachment 3** is a 2009 Water Delivery Report for JID. The table also provides general water supply data for 1994 to 2009. Between 1994 and 2009, JID pumped an average of 29,500 AF/year of groundwater (39% of total supply), and imported an average of 46,600 AF/year of surface water (61% of total

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water supply). JID has a goal to reduce their overall water demands through water conservation and water management efforts.

For more general information on JID refer to the James Irrigation District Water Conservation Plan – 2009 Update.

### **1.2 - Goals and Objectives of Groundwater Management Plan**

The overall purpose of this GMP is to develop a coordinated and comprehensive approach to the evaluation and management of groundwater resources within the City of San Joaquin, James Irrigation District, and the James Irrigation District "East Side Wellfield" which is outside the District boundaries. Specific goals of this plan include the following:

1. Develop a consensus among agency staff and stakeholders on the current groundwater conditions, need for proactive groundwater management, and problems that need to be addressed.
2. Document goals and objectives for sustaining existing efforts and improving groundwater management.
3. Develop practical solutions for addressing groundwater issues, especially groundwater overdraft.
4. Improve communication between the City of San Joaquin and JID, and increase awareness of each agencies groundwater management concerns, programs and goals.
5. Provide a realistic and feasible implementation plan for short-term and long-term groundwater management efforts.

This GMP documents the existing groundwater management efforts in the Plan Area and planned efforts to improve groundwater management. Specific groundwater management goals documented in this GMP include:

1. Preserve and enhance the existing quality of the area's groundwater.
2. Preclude surface or ground water exports that would reduce the long-term supply of groundwater.
3. Coordinate groundwater management efforts between regional water users.
4. Maintain local management of the groundwater resources.
5. Implement a groundwater-monitoring program to provide an "early warning" system to future problems.
6. Stabilize groundwater levels in order to minimize pumping costs and energy use, and provide groundwater reserves for use in droughts.
7. Maximize the use of surface water, including available flood water, for beneficial use.

In addition, the Plan Participants will take a proactive role in the legislative process, participate in developing sound legislation concerning groundwater management if it

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becomes necessary, and take an active role in opposing any legislation that is detrimental to local groundwater management efforts.

### **1.3 - Statutory Authority for Groundwater Management**

The City of San Joaquin and James Irrigation Districts are both public agencies with the authority to manage groundwater and prepare Groundwater Management Plans. California Assembly Bill 3030, as chaptered, (California Water Code, Division 6, Part 2.75, SEC. 10750-10753.9) grants specified “local agencies” authority to undertake groundwater management. AB 3030 also confers upon local agencies the powers of a water replenishment district. These authorities remained unchanged with the amendments to the law provided by California Senate Bill No. 1938, which was passed in 2002 and outlines additional requirements for GMPs. Agencies adopting a GMP are authorized to enter into agreements with other local agencies or private parties to manage mutual groundwater supplies, including those existing in overlapping areas.

### **1.4 - Lower Kings Basin Groundwater Management Plan**

The Kings River Conservation District has developed a regional GMP that includes the area covered by James Irrigation District and the City of San Joaquin. The GMP is called the ‘*Lower Kings Basin Groundwater Management Plan*’ (Regional GMP) and was prepared in April 2005. The GMP is compliant with Senate Bill 1938 and discusses regional geography, geology and hydrogeology, regional groundwater problems, and regional basin management objectives. The Regional GMP includes several study areas and JID and the City are included in study ‘Area A’. One important goal in the Regional GMP is the development of an improvement district for all of Area A to jointly fund regional studies, projects and monitoring.

JID and the City did not participate in the development of the Regional GMP. However, JID found many of the goals and objectives in the regional GMP to be compatible with their needs and beneficial for JID and the region. As a result, JID passed a District Resolution (No. 2007-03) supporting the Regional GMP. As a result, JID will have two GMPs: this document and the Regional GMP. This document will help guide local and regional groundwater management, and the Lower Kings Basin GMP will help guide regional groundwater management.

### **1.5 - Groundwater Management Plan Components**

This GMP includes the required and voluntary components for a GMP as identified in California Water Code Section 10753, et. seq. This Plan is also consistent with the recommended elements for a GMP as identified in DWR Bulletin 118 (2003), Appendix C. **Table 1.2** identifies the location within this document where each of the components is addressed.

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**Table 1.2 – Location of Groundwater Management Plan Components**

Description	Plan Section(s)
<b>California Water Code Mandatory Requirements (10750 et seq.)</b>	
1. Documentation of public involvement	1.5, Appendix A
2. Groundwater basin management objectives	1.2, 3
3. Monitoring and management of groundwater elevations, groundwater quality, land subsidence, and surface water	5
4. Plan to involve other agencies located in the groundwater basin	4.3
5. Monitoring protocols	5.3
6. Map of groundwater basin and agencies overlying the basin	<b>Figure 2</b>
<b>California Water Code Voluntary Components (10750 et seq.)</b>	
7. Control of saline water intrusion	6.3
8. Identification and management of wellhead protection areas and recharge areas	6.2, 7.2
9. Regulation of the migration of contaminated groundwater	6.3, 6.4
10. Administration of well abandonment and well destruction program	6.1
11. Mitigation of overdraft conditions	7.1, 7.2
12. Replenishment of groundwater extracted by water users	7.2
13. Monitoring of groundwater levels and storage	5.1, 9.2
14. Facilitating conjunctive use operations	7.3
15. Identification of well construction policies	8.1
16. Construction and operation by local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	6.4, 7, 8.2
17. Development of relationships with state and federal regulatory agencies	4.2, 4.3
18. Review of land use plans and coordination with land use planning agencies	9.1
<b>Additional Components Recommended by DWR (App. C of Bulletin 118)</b>	
19. Advisory committee of stakeholders	4.1
20. Description of the area to be managed under the Plan	1.1, 2
21. Descriptions of actions to meet management objectives and how they will improve water reliability	4 - 9
22. Periodic groundwater reports	9.2
23. Periodic re-evaluation of Groundwater Management Plan	9.4

### **1.6 - Adoption of Plan**

Refer to **Appendix A** for documentation on the adoption of the GMP and the public process that was followed.

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### Public Participation in Plan Development

The public was invited to participate in the development of the updated GMP through newspaper notices and public hearings described below.

### Preparation of Integrated Plan with City and JID

JID began to update their GMP in 2009. JID contacted several local agencies to solicit their input on the GMP. The City of San Joaquin was the only agency that expressed interest in the local groundwater management, and requested that the two agencies prepare a joint integrated Groundwater Management Plan. In April 2010, the two agencies signed a Memorandum of Understanding to cooperate on local groundwater management (see **Appendix E**) and prepare a joint GMP.

### Groundwater Advisory Committee

The City of San Joaquin and JID used their City Council and Board of Directors, respectively, as groundwater Advisory Committees during preparation of this GMP. The two agencies plan to form a joint GAC for implementing the GMP after it is adopted. The joint GAC will include representatives from JID and the City that can represent and speak for the local interests. Several special sessions on groundwater issues were held at JID Board of Directors and City Council meetings. The GAC were also given a draft copy of the GMP to review. The GAC provided several insightful and useful comments for managing groundwater that were incorporated into the GMP.

As required by the California Water Code Section 10753.2 (a), JID and the City published a series of public notices, held public meetings, and adopted resolutions required for preparing and adopting this GMP. No comments were received from the public other than those offered by the Groundwater Advisory Committees. These public outreach efforts are summarized in Table 1.3 below.

**Table 1.3 – Public Participation in Groundwater Management Plan Adoption**

<b>Phase of Public Noticing</b>	<b>Description</b>	<b>James Irrigation District</b>	<b>City of San Joaquin</b>
Intent to prepare GMP	Notice of hearing published	12-31-08/1-7-09	4-10/5-10
	Hearing held. Resolution adopted.	1-13-09	5-12-10
	Resolution published	4-8-09/4-15-09	7-7-20/7-14-09
GMP Adoption	Notice of hearing published	9-29-10/10-6-10	9-29-10/10-6-10
	Hearing held. Resolution adopted.	10-19-10	10-13-10

The hearing at JID was advertised for October 12, 2010, but JID was forced to reschedule their Board meeting to October 19, 2010. However, no one appeared at the JID office for the October 12 meeting, and no comments were received at the October 19 Board meeting.



## **2 - GEOLOGY AND HYDROGEOLOGY**

This section discusses the geology and hydrogeology of the City of San Joaquin, JID, JID eastside well field, and the surrounding area. The purpose of this section is to provide general background information on the local geology, hydrogeology and water chemistry that will aid in selecting and implementing groundwater management programs. Most of the information in this section was derived from City of San Joaquin records, JID records, USGS Professional Paper 1401-C, USGS Water Supply Paper 1999-H, and a report prepared by the United States Bureau of Reclamation for Tranquillity Irrigation District.

The following sections include technical discussions on the plan area's groundwater. These are intended to provide geologists, engineers, and water managers a greater understanding of the area's stratigraphy, groundwater conditions, and hydrogeologic parameters. Less technical discussions on groundwater management programs are provided in Sections 3-9 of this document.

### **2.1 - Regional Geology**

The San Joaquin Valley is the southern part of a large, northwest-to-southeast trending asymmetric trough of the Central Valley, which has been filled with up to six vertical miles of sediment. This sediment includes both marine and continental deposits ranging in age from Jurassic to Holocene (recent). The San Joaquin Valley lies between the Coast Ranges on the west, the Sierra Nevada on the east, and extends northwestward from the San Emigdo and Tehachapi Mountains to the Delta near the City of Stockton. The San Joaquin Valley is 250 miles long and 50 to 60 miles wide. The relatively flat alluvial floor is interrupted occasionally by low hills.

The San Joaquin Valley is divided into several geomorphic land types including dissected uplands, low alluvial fans and plains, river floodplains and channels, and overflow lands and lake bottoms. The alluvial plains cover most of the valley floor and comprise some of the most intensely developed agricultural lands in the San Joaquin Valley. In general, alluvial sediments of the western and southern parts of the San Joaquin Valley tend to have lower permeability than eastside deposits. The lower permeability in material along the western and southern portions of the valley is mainly attributed to the fine-grained nature of the parent material from which the alluvium is derived. The sediments are predominately marine in origin and consist of the thick sequences of mudstone, claystone, and siltstone that make up the Coast Ranges. Upon weathering and transport down slope along alluvial fans, these sediments readily decrepitate into fine-grained materials consisting mainly of silt and clay found along the axis of the valley trough.

Near the valley trough, fluvial deposits of the east and west sides grade into fine-grained deposits termed Flood-basin deposits by Page (1986) or Basin Sediments by USBR (1955). The San Joaquin Valley has several thick, fine-grained, lacustrine

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deposits. The Corcoran Clay Member of the Tulare Formation is the most notable fine-grained deposit in the San Joaquin Valley affecting groundwater quality and creates confined groundwater conditions below. The Corcoran Clay was deposited about 600,000 years ago in the Tulare Lake. This clay bed, which is found in the western and southern portions of the valley, separates the upper semi-confined to unconfined aquifer from the lower confined aquifer. The clay bed covers approximately 5,000 square miles and is up to 160 feet thick beneath the present bed of Tulare Lake and thins with distance from the center of origin.

#### Regional Hydrogeologic Setting

An enormous aquifer system lies beneath the Kings Basin and extends the length and breadth of the San Joaquin Valley. The valley is a broad structural trough, with the Sierra Nevada Mountains on the east and the Coast Range mountains on the west. The Sierra basement rock extends from the foothills on the east, sloping downward to the southwest at 4° - 6°. Consolidated and unconsolidated continental and marine deposits from both the Sierra and the Coast Range mountains overlie this basement complex. Unconsolidated alluvial deposits make up most of the basin's freshwater aquifer (Croft, 1972).

Interspersed within the unconsolidated deposits that comprise the useable aquifer in the region are a number of clay layers that can act as confining beds or perching layers. The confining bed that has greatest significance to the Plan Area is known as the Corcoran Clay, or 'E' Clay. The 'E' Clay underlies the entire Plan Area (**Figure 5**). **Figure 9** is a generalized cross section of the Plan Area. Two other significant clay layers also partially underlie the Plan Area. However, neither the 'C' Clay on the extreme northern edge of the District, nor the 'A' Clay have as a significant impact on the Plan Participants use of the aquifer as the Corcoran clay. However, recent studies completed by JID for the K-Basin recharge project indicates that there, the 'C' Clay may be present, extending the 'C' Clay several miles southeast as mapped by USGS (1972).

JID wells primarily tap the unconfined aquifer lying above the 'E' Clay. The top of this clay occurs at a depth of around 500 feet below ground level within the District. Originally, most District wells constructed in the 1910's and 20's tapped the aquifer below the E-clay. Many of these wells initially exhibited artesian flow, reflecting the confined groundwater conditions below the Corcoran clay. The use of wells within District boundaries which tap the confined aquifer below the E-clay was slowly phased out due to its poorer water quality, generally lower yields, and more expensive well construction costs. However newer wells are constructed on a case by case basis, and built to recover the highest quality water at a given location, whether that is above or below the Corcoran clay. As a result, some wells tapping the confined aquifer are now constructed.

Groundwater in the plan area is divided into three separate non-marine, water bearing zones. These include the lower water-bearing zone, upper water-bearing zone, and the perched or shallow zone, as discussed below.



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- The **lower water-bearing zone** contains fresh water in the lower section of the Tulare Formation from the base of the E-clay (Corcoran Clay) to the base of fresh water or the top of connate, saline marine water. USBR (1955) terms the base of the fresh water aquifer as the base of the effective ground-water reservoir. The depth to the base of fresh water is from about 1,000 feet to 1,400 feet beneath the Plan Area (Page, 1973).
- The **upper water-bearing zone** is from the top of the Corcoran Clay to the upper sections of the Tulare Formation, often considered the bottom of the A-clay.
- The **shallow or perched zone** underlies the portion of the Plan Area from the City of San Joaquin and northward, from the top of the A-clay, if it is present, to the perched groundwater table which is often within 10 feet or less of the ground surface. DWR Bulletin 118-03 uses 25 feet below ground surface (bgs) as a general vertical depth limit for the base of the perched zone.

#### Subsidence

Land subsidence in the San Joaquin Valley has been studied extensively in the past by the USGS and DWR. A State-Federal committee on subsidence was formed in the early 1950's and performed research and measured subsidence until 1970. By 1970, 5,200 square miles in the Valley had subsided more than 1 foot. Land subsidence of up to 16 feet has been experienced in the southern portions of the San Joaquin Valley basin. Between 1926 and 1970, a maximum of 29.7 feet of subsidence was measured at a point southwest of Mendota. The compacting forces caused by groundwater level decline squeezed more than 15.6 million AF of water storage space out of valley sediments during the same period.

There are two types of land subsidence due to groundwater withdrawals; elastic and inelastic. Elastic subsidence is not permanent and is largely reversible, if water levels recover to above historic lows. Recent studies indicate that current subsidence west of the plan area is primarily elastic in nature, and will likely not be inelastic until water levels fall below historic lows. Inelastic subsidence is permanent and occurs when water is removed from a confined aquifer for the first time, and is sometimes referred to as virgin subsidence. Between the mid-1920's to about 1980, the San Joaquin Valley experienced inelastic, non-recoverable subsidence.

The most recent reports on land subsidence in the San Joaquin Valley were completed by R. L. Ireland of the USGS in 1986 and Arvey A. Swanson of DWR in 1995. Ireland (1986) states that *"Land subsidence to groundwater withdrawal in the San Joaquin Valley that began in the mid-1920's and reached a maximum of 29.7 feet in 1981 has been halted by the importation of surface water through major canals and the California Aqueduct in the 1950's through 1970's."* This was generally true at the time, because large scale regional subsidence had halted, but smaller-scale local subsidence continued in many areas.

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Poland et al. (1975) estimated that cumulative non-recoverable land subsidence from 1926 to 1972 in the vicinity of the Plan Area was on the order of 4 feet. A land subsidence contour map shows lowering of the land surface due to land subsidence was exacerbated west of the Plan Area and cumulatively, for the period of record, was as much as 8 feet in this area.

As land subsidence is a function of groundwater pumpage and recharge, it is linked to drops in groundwater levels. **Appendix C** shows hydrographs for wells monitored by DWR in the Plan Area. The DWR hydrographs show periodic increases in water levels, but the overall trend is a steady decline in water levels from the 1960's to today. Other hydrographs in the area prepared for KRCD's 2005 Lower Kings Basin Groundwater Management Plan Update and JID's 2001 GMP show continued decreases in water levels. Recent drops in groundwater levels are likely a result of low precipitation years, and the increased reliance on groundwater in the area to supplement surface water supplies.

Poland et al. (1975) show a direct correlation between subsidence and pumpage. In a 1996 draft memo, DWR indicated that from 1975 to 1992 subsidence occurred primarily in drought years when groundwater supplies replaced surface water supplies. The most recent record of land subsidence in the area is from Swanson (1995), where he indicates that 2 feet of subsidence occurred along the Outside Canal near Mendota Dam between the years of 1970 and 1994. However, it is not known how much of the 2 feet of subsidence reported by Swanson was residual subsidence, continued from pre-surface water delivery pumpage west of the Plan Area. Data from 6 extensometers located west of the Plan Area indicates that subsidence there has been elastic since about 1977.

With the recent reductions in surface water supplies for CVP contractors, the demand on the regional aquifer system's groundwater will likely increase. A link between land subsidence and pumpage is well established west of the District. Therefore, studies should be conducted to determine the susceptibility of subsurface deposits to land subsidence with increasing groundwater demand, especially if newly constructed wells tap the confined aquifer.

### **2.2 - Groundwater Basin**

The James Irrigation District and City of San Joaquin are in the Kings Groundwater subbasin (Kings Basin) in the San Joaquin Valley Groundwater basin of the Tulare Lake Hydrologic Region (DWR 2003). See **Figure 2** for a map of the regional groundwater subbasins. The Kings subbasin has been identified by the DWR as a basin with boundaries appropriate for ground water management purposes (DWR Bulletin 118-80). These boundaries were identified on the basis of geological and hydrological conditions, as well as political boundary lines. There are 19 court adjudicated basins in California, most of them in Southern California or coastal regions of California. The Kings Groundwater Subbasin is not included in the list of adjudicated basins, however DWR Bulletin 118-03

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identifies eleven basins in California as being in critical conditions of over draft and the Kings Basin is included on the list.

### Geography

The Kings Basin covers 976,000 acres. The Kings Basin extends from the Sierra Nevada foothills on the east to the San Joaquin Valley trough on the west, and from the San Joaquin River on the north to roughly the Fresno County line on the south. The Kings Basin also includes small portions of Kings and Tulare counties. The Plan Participants lie in the northwest portion of the Kings Basin and is bounded to the west by the southern extension of Delta-Mendota subbasin (**Figure 2**). The Westside Groundwater Subbasin borders the southwest portion of the District. The San Joaquin and Kings Rivers are the two principal rivers within or bordering the Kings Basin. There are no hydrogeologic features that would prevent groundwater from flowing between the Kings Basin to the Delta-Mendota or Westside Sub-basins, located to the west.

### Tulare Lake Hydrologic Region

The Kings Basin (DWR subbasin No. 5-22.08) lies within the Tulare Lake Hydrologic Region, which covers approximately 10.9 million acres (17,000 square miles) and includes all of the Kings and Tulare Counties and most of Fresno and Kern Counties. The region has 12 distinct groundwater basins and 7 sub-basins of the San Joaquin Valley Groundwater Basin.

Groundwater has historically been important to both urban and agricultural uses, accounting for 41 percent of the Hydrologic Region's total annual supply and 35 percent of all groundwater use in the State. The aquifers are generally quite thick in the San Joaquin Valley subbasins with groundwater wells commonly exceeding 1,000 feet in depth. The base of fresh groundwater in the region, at an average of about 1,200 feet below ground surface, is considered to be the maximum effective depth of the basin in terms of pumping and recharge. According to Bulletin 118-2003, well yields average 500 to 1500 gpm, with a maximum of 3,000 gpm (this agrees with data for JID wells).

### Groundwater Quality for the Tulare Lake Hydrologic Region

In general, groundwater quality throughout the region is suitable for most urban and agricultural uses with only local impairments. The primary constituents of concern are high total dissolved solids (TDS), nitrate, gross alpha, arsenic and organic compounds. The areas of high TDS content are primarily along the west side of the San Joaquin Valley and in the trough of the valley. High TDS content of west-side water is due to recharge of stream flow originating from marine sediments in the Coast Range. High TDS content in the trough of the valley, especially in water close to the surface, is the result of concentration of salts because of evaporation and poor drainage. According to DWR Bulletin 18-2003, TDS in groundwater in the Kings Basin ranges from 40 to 2,000 mg/L with an average of 200-700 mg/L. Groundwater quality specific to JID and the City of San Joaquin is discussed in detail in Section 2.6 below.

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### Groundwater Budget

According to the DWR Bulletin 118-03, in the Tulare Lake Hydrologic Region the San Joaquin Valley Basin only has two subbasins ranked as a Type "C" groundwater budget; Kings and Westside. A Type C budget indicates that there are not enough data to provide either an estimate of the basin's groundwater budget or groundwater extraction from the basin. This suggests a low level of knowledge exists on groundwater inflow, outflow, or storage information in the Kings basin. The C budget type is for the whole subbasin, not just the Plan Area, so it will take collaboration to get information needed to bring the subbasin to a budget type classification of A, which is based on actual groundwater budgets or models, or B which is a use-based estimate of groundwater extraction (using evapotranspiration demand). The Kings Subbasin was determined in DWR Bulletin 118-80 to be a "*critically overdrafted*" basin. This designation was not reevaluated when the bulletin was updated in 2003.

### 2.3 - Stratigraphy

The following discussion focuses on significant hydrogeologic units that have an impact on the groundwater resources within the Plan Area. From the surface to the base of the effective groundwater reservoir, about 1,200 feet bgs, important hydrogeologic units are topsoil, alluvial fan deposits of eastside origin, basin sediments, the A-, C-, and E- (Corcoran) clays, and alluvial deposits below the E clay, and to a lesser extent alluvial deposits of Westside origin. Depth to bedrock is too deep under the Plan Area to impact groundwater conditions and therefore will not be discussed here.

#### Topsoils

Soils in the District and vicinity range from coarse sands to heavy clays. In the middle and western portions of the Plan Area the soils generally have a higher clay content. These soils developed on sediments deposited in the valley trough during flood periods. The parent material of these soils is flood basin deposits and fine-grained alluvium of mixed granitic and sedimentary origin from both the Sierra Nevada and Coast Range Mountains. Soils in the eastern portion of the Plan Area and the JID eastside wellfield generally have higher sand content and are derived mostly from granitic Sierra Nevada sediments deposited on alluvial fans. The increase in sandier materials to the east extends into the subsurface and partially explains why more wells are located in the eastern side of JID than the western side. Soils throughout the vicinity of the Plan Area are stratified, with interspersed sandy and clayey streaks. **Figure 4** is a composite of United States Department of Agriculture soil survey maps which cover the Plan Area.

#### Subsurface Geology

The USBR (1955) provides the most focused and detailed descriptions of the subsurface geology in the Plan Area. While the USBR report was prepared for Tranquillity Irrigation District, it also covers the Plan Areas and east to R.17E/R.18E section line (approximately 2 miles east of the eastern JID border). The following discussion on subsurface geology is based on the descriptions found in USBR's report. Surface deposits, as mapped by the USBR, include eastside inactive alluvial fan deposits that cover the Plan Area east of James Bypass. From about the James Bypass

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westward surface deposits are composed of Basin Sediments deposited in the axis of the valley during wet climatic cycles. Beneath these sediments lies the Corcoran clay, a regional lacustrine clay that causes confined groundwater conditions below it. Below the Corcoran clay, Sierran alluvial sediments dominate to depths greater than 3,000 feet bgs. These sediments are considered part of the Tulare Formation and are discussed in further detail below. Within the Tulare Formation seven lacustrine clays are mapped to varying extent in the San Joaquin Valley. In the Plan Area the A-clay, C-clay and E-clay or Corcoran clay are the most important of the mapped clay lacustrine clays. Several geologic cross sections passing through JID, the JID Eastside Wellfield, and the City of San Joaquin are included in **Appendix B**. The locations of the cross sections are shown on **Figure 4**.

#### **Alluvial Fan Deposits of Eastside (Sierran) Origin**

Surficial deposits of eastside origin are roughly found east of the James Bypass. The alluvial fan deposits above the Corcoran clay are predominately of eastside (Sierran) origin and comprise lenticular beds of sands and silts derived primarily from granitic rocks with rare clay laminae. These sediments probably represent deposits of former Kings River and San Joaquin River distributaries and are geographically higher than alluvium deposits of the active fans. They are slightly wind modified and soils that form on them tend to be saline; developed under conditions of high water table and little sedimentation. USDA-SCS soil classification for soils that formed on the inactive alluvial fans are sandy loam to fine sandy loam, with the finer grained soils dominating near James Bypass (**Figure 4**). Beneath the topsoil the sands vary from fine to medium-grained sizes and coarse sands and gravels are rare. The deposits generally become finer westward; grading into the Basin sediments discussed below. Fine-grained deposits dominate in the western portion of the area where they finger into the Basin sediments. This alluvial sequence occurs from the surface to depths of 500-550 feet bgs. Most of the wells in the JID eastside well field are completed in these deposits. These sediments, while all Sierran fluvial, represent three distinct environments of deposition. Clays and silt/clay mixtures represent deposition in lakes or marshes, well sorted sands and silts represent deposition in water with current such as streambeds or lake beaches, and poorly-sorted silt and clay fractions indicate floodplain origins.

#### **Basin Sediments**

West of the alluvial fan deposits of eastside origin (roughly James Bypass) surface deposits are comprised of Basin sediments. The Basin sediments are along the trough of the valley and consist of material of mixed Sierran and Coast Range origin. The Basin sediments are fine sands, silts, and clays. Soils that formed on the Basin Sediments are classified by the USDA-SCS as clay loam and clay. Under natural conditions these deposits are poorly drained, frequently flooded, and ponded or marshy. These sediments grade westward into inactive alluvial fan deposits of Westside (Coast Range) origin.



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The A-clay is one of seven recognized lacustrine clay beds in the San Joaquin Valley (**Figure 6**). It was deposited in a widespread lake and is found almost continually beneath the topographic axis of the valley. While not comprised of alluvium of eastside origin or Basin Sediments, stratigraphically it is located within these units, and thus is discussed here. The top of it is often the base of the perched or shallow ground water zone. The A-clay, as mapped by Croft (1972), extends under the Plan Area from the City of San Joaquin northwestward (**Figures 6**). The base is about 60 to 75 feet beneath the land surface and generally it is between 5 to 70 feet thick. Structure contours drawn on the base of the A-clay indicate that it is relatively flat beneath the northern portions of JID. The A clay is an aquitard, not yielding significant water to wells, and in fact is a perching layer stopping the downward migration of water from the surface.

The C-clay is another of one of the seven recognized lacustrine clay beds in the San Joaquin Valley. In the JID area its extent is similar to the A-clay, but it was not mapped with the same level of certitude by Croft (1972) as the overlying A clay or the underlying E-clay. Recent subsurface investigations by JID for the K-Basin recharge project indicate that the C-clay is likely present there at a depth of 235 to 253 feet bgs. These depths correspond to Croft's mapping of the C clay where, in the northern portions of the District, it is roughly 240 to 260 feet bgs. The Report of Findings for Potential Banking Facilities (Provost and Pritchard, 2005) indicates that, based on the results of pump tests at the Lateral K Basin, there is only a small hydraulic connection between groundwater in strata above and below the C-clay.

#### **Alluvial Deposits Beneath The Corcoran Clay**

Beneath the Corcoran clay a series of granitic sands, silts, and occasional clays extends to depths greater than 1,200 feet. These sediments were deposited by alluvial fans debauching from the Sierra Nevada Mountains and resemble beds of similar origin above the Corcoran clay, but are texturally coarser grained. While most of the recently built wells, as of 2003, are completed in the alluvial deposits above the Corcoran, two wells built around 1950 were completed to depths below the Corcoran clay. Of these two wells one is abandoned and records indicate that the other is no longer in use. This unit contains the base of the effective groundwater reservoir, as described below. Water quality in this zone is discussed below but generally is of much better quality than water above the Corcoran clay. Currently the District designs and constructs wells based on site specific conditions and wells may be perforated above or below the Corcoran clay.

#### **Corcoran Clay**

The Corcoran Clay, also known as the E-clay, is a lacustrine clay bed of lake or swamp origin that effectively underlies the entire Plan Area. The Corcoran clay has long been recognized as the most significant subsurface deposit in the San Joaquin Valley confining water beneath it. It is the upper most boundary of the confined aquifer and the lower most boundary of the unconfined aquifer. The easterly extent of the E-Clay is shown on **Figure 5**. Structure contours drawn on the bottom show it to be about 560 to

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620 feet beneath the surface in the plan area (Croft, 1972). Page (1986) provides structure contours to the top of the Corcoran clay. Based on Page's interpretation, the depth to the top is between 500 to 550 feet over the majority of the area with a thickness of 20-40 feet. The structure contours reveal the structure of the clay as a southerly dipping anticline with about 50 feet of relief from the north to south beneath the JID area. On well completion reports it is commonly described as blue or green clay, claystone, or siltstone. The Corcoran Clay has also been described as greenish-grey, dense, compact, and non-laminated claystone or siltstone. The bottom 20 feet is usually silty and it is a characteristic marker on E logs. A few scattered sand lenses exist and in the eastern portions of the area can make up as much as 30 percent of the clay sequence.

### **Alluvial Deposits of Westside Origin**

The Plan Area, being near but east of the axis of the valley, has for the most part been dominated by deposition from the Sierra Nevada. However, there is some indication that subsurface deposits west of JID originated from the Coast Ranges. Contemporaneous deposition from eastside and westside sources is shown in a drill hole located in 15S/16E, Section 17E (about 1 mile west of the Plan Area) at depths of 22 feet where westside deposits overlie eastside deposits. This indicates that the sediments from the two sources occur and overlap west of the Plan Area. USBR (1955) indicates that the westside deposits thin and pinch out easterly. While these sediments probably form a minor component of the area's useable aquifer, water originating from these sediments to the west could have a great impact on water quality.

## **2.4 - Aquifer Characteristics**

### **Specific Yield**

In order to establish the storage capacity of the underground reservoir it is necessary to derive estimates of the specific yield of the sediments. USBR (1955) derived estimates of specific yield for the upper water-bearing zone within JID. These values are based on specific yield estimates from two separate studies done in similar geologic settings. The USBR report defined the upper water-bearing zone as the depth interval between the 1948 static water level in shallow wells and the top of the Corcoran clay (about 30 feet to 500 to 550 feet bgs). USBR computations show specific yield for JID ranges from as high as 22 percent to as low as 6 percent for the sediments above the Corcoran clay. Specific yield contours show a tongue of higher specific yield extends southwestward across the northern portions of the JID area corresponding to eastside alluvial sediments. The higher specific yields are associated with this tongue of coarser grained sediments of Sierran origin.

Based upon estimates of specific yield by the USGS and the DWR, the average specific yield of the unconfined aquifer was estimated to be about 11 percent for the District and about 12 percent for the Eastside well field area. Findings from the KRCD Groundwater Management Plan Update (2005) indicate that specific yield in JID is 11.3 to 12 percent.

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### Safe Yield

Safe yield, or perennial yield, is difficult to quantify because of the shared nature of the aquifer and uncertainty in defining the term. In this analysis perennial yield is defined as the amount of pumping that can be supported over an average hydrologic base period that will not result in a long-term decline in water levels. The base period must be long enough to include both wet and dry hydrologic cycles.

One factor complicating the estimate of perennial yield for JID is that the District and Eastside well field region is not a "closed" ground water basin. That is, groundwater in the region is hydraulically connected to groundwater in adjacent areas within both the "Kings Basin" and the "Tulare Lake Hydrologic Region". If groundwater management activities substantially raised static water levels subsurface inflow would decrease, subsequently decreasing perennial yield.

A previous analysis performed by Provost & Pritchard Consulting Group, Inc. investigated the safe yield using the hydrology from 1975 to 1993. The analysis concluded that the perennial yield for JID is approximately 1,000 AF per year less than the District's estimated average annual pumping of 12,500 AF from within the District, and about 2,700 AF per year less than the average annual pumping from the Eastside well field. This results in an estimate of perennial yield of 11,500 AF per year for JID. Total average annual pumping for the Eastside well field area is unknown as the District's wells account for just a portion of the region's pumpage. Private irrigation wells pump an unknown additional amount. However, the total average annual amount pumped in the study period (1975-1993) appears to be around 2,700 AF per year more than the perennial yield.

### Storage Capacity

If it is assumed that the useable ground water reservoir is the unconfined aquifer lying above the E-clay, an estimated ground water storage capacity can be calculated. The elevation of the base of the E-clay averages about 400 feet below sea-level within the District, with an average thickness of around 80 feet. The average ground surface elevation in the District is about 175 feet, resulting in an average total depth for the unconfined aquifer of about 495 feet. Assuming that it is undesirable to have the water table less than ten feet from the ground surface, the average thickness of the useable aquifer is around 485 feet. Applying an average specific yield of 0.11, and multiplying by the total District area of 26,392 acres results in an estimate of total unconfined aquifer storage capacity of 1,400,000 AF.

### Groundwater Quantity

The entire District and surrounding lands overlie portions of an enormous aquifer. For water quality reasons most of the ground water pumping occurs along the Fresno Slough and eastward. The District currently operates about 60 turbine pumps which tap this aquifer.



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The combined capacity of the wells in 2008 was approximately 93,310 gallons per minute (gpm), or around 208 cubic feet per second (cfs). The locations of the District wells are shown on **Figure 3**. As of 2007 there were only two known private in JID wells being used to supplement District water supplies.

Under the authority of a groundwater deed recorded on September 1, 1920, JID pumps a large portion of their ground water supply from outside the District. The area encumbered by the ground water deed is shown on **Figure 3**. The District operates a wellfield east of the Fresno Slough Bypass consists of about 35 wells feeding two canals; the Lassen Avenue Canal and the McMullin Grade Line (**Figure 3**). From 1986 to 1994, which was largely a drought period, the eastside wells supplied an average annual supply of about 21,000 AF. This was a little more than half of the District's total ground water pumping, which averaged around 42,000 AF per year through the same period.

JID generally uses surface water to the extent it is available and supplements it as necessary with groundwater. In years of average surface water supply total ground water pumping can be expected to be around 25,000 to 35,000 AF, with 15,000 to 20,000 AF coming from the eastside wellfield.

#### Transmissivity

Transmissivity data for the Plan area is sparse. Schmidt (2004) derived transmissivity values from a 5-day pumping test performed on Well C-81 at the K Basin. Schmidt notes that the transmissivity values are valid for the aquifer below the C-clay at that location. The perforated interval of the well from 250 to 500 feet bgs indicates that this well taps the aquifer between the C-clay and the Corcoran clay. Transmissivity values from that pumping tests ranged from 73,000 gpd/ft to 48,000 gpd/ft.

A study by Davis et al., (1964) summarized numerous regional specific capacity values from Pacific Gas & Electric pump tests performed across the San Joaquin Valley. Using data from field tests in the JID area, they calculated specific capacities ranging from 57 to 85 gpm per foot. Driscoll (1986) provides an approximate relationship between specific capacity data and transmissivity. Using this method, transmissivity values for the northern part of JID range from 106,500 to 127,500 gpd/ft, and range from 85,500 to 86,000 gpd/ft in the southern portion of the District. These values of specific capacity and transmissivity are probably valid for the unconfined aquifer, as at the time of the report most wells drilled in the area were most likely completed above the E-clay.

The City of San Joaquin performed pump tests in their Well No. 5 in July 2003. Estimated specific capacities ranged from 10.7 to 11.0 gpd/ft. Drawdown measurements from a step-drawdown test indicated a transmissivity of 43,000 gpd/ft, and for a constant discharge test indicated 39,000 gpd/ft.

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### Wells Yields and Depths

Well yields in JID range from around 400 to 2,000 gallons per minute (gpm), with most around 1,000 to 1,500 gpm (**Attachment 2**). Wells in the east side wellfield have yields ranging from about 800 to 2,300 gpm, with the typical well producing about 1,500 gpm. Well depths in the East-Side Well Field and along the James Bypass average about 500 feet deep ranging from 365 to 808 feet.

The characteristics of the three wells in the City of San Joaquin are shown in **Table 2.1** below.

**Table 2.1 – City of San Joaquin Wells**

Description	Well No. 3	Well No. 4	Well No. 5
Total Depth	510 ft	500 ft	495 ft
Perforated Interval	210-510 ft	300-500 ft	300-435 ft
Year Constructed	1968	1978	2003
% of City water in 2009	50	8	42
Yield	1,200 gpm	1,200 gpm	1,100 gpm

## **2.5 - Groundwater Levels**

### Regional Groundwater Levels

**Figure 7** is a map showing regional groundwater levels (this map represents the best available depiction of regional groundwater depth, despite being slightly dated). Groundwater depths range from about 40 to 150 feet bgs in the Plan Area. Groundwater generally flows from northwest to southeast, and there is a considerable groundwater depression east of the Plan Area in the Raisin City Water District.

### Historical Ground Water Levels

**Appendix C** includes a collection of hydrographs for indicator wells in JID. Groundwater level data is not available for the City of San Joaquin, but groundwater levels in the City are assumed to be similar to those shown on regional map (**Figure 7**).

Prior to development of JID, regional groundwater levels were typically within ten feet of the ground surface, and wells tapping the aquifer below the E-clay initially exhibited artesian flow. As land was brought into agricultural production, and with the advent of deep well turbine pumps, groundwater levels began to decline. By about 1950 water levels had begun a sharp decline that continued into the mid-1970's. In this period a significant portion of the unconfined aquifer was dewatered, and a large cone of depression developed outside of JID in the Raisin City area.

Beginning in the mid-1970's and continuing to the present, is a trend of much slower ground water decline. Water levels have continued to fluctuate in response to drought and

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flood years but have not exhibited nearly as strong a downward trend. This slowing in groundwater level decline probably resulted from increased groundwater inflow induced by the large cone of depression that has formed in the region, as well as groundwater recharge projects implemented by JID.

Water levels in wells tapping the confined aquifer in the region west of JID, (below the E-clay) also declined precipitously through the 1950's and 60's. However, due to the confined nature of the aquifer, these declines track the piezometric or pressure surface of the ground water, and therefore do not indicate a physical reduction of water in storage in the confined aquifer. This downward trend reversed dramatically in the mid-1960's in response to initiation of delivery of imported surface water from the USBR's Central Valley Project (CVP). This surface water supply resulted in decreased pumping from beneath the E-clay in regions west of JID. Water levels in wells pumping from the confined aquifer once again began to decline steeply in the early 1990's when imported water supplies declined as a result of an extended drought.

The Lower Kings Basin GMP provided an evaluation of regional groundwater levels in the Kings Basin. The GMP concluded that there has been a significant regional decline in groundwater levels between 1950 and 2000 and estimate a continued decline. The construction and operation of Pine Flat Dam, while helping to address groundwater issues by providing surface water, has not completely mitigated overdraft conditions in the Lower Kings Basin. According to the GMP, the average annual rate of groundwater overdraft in the Lower Kings Basin is 68,000 AF/year. Groundwater levels are expected to decline in the future if current groundwater management practices remain unchanged.

### **2.6 - Groundwater Quality**

Overall ground water quality has not appeared to change significantly over the years. Ground water quality is generally better on the east side of the District, although salt plumes caused by the unregulated discharge of oil-field brines have degraded ground water in the District's east side wellfield. The poorer quality ground water on the west side of the District is apparently now advancing further into JID.

Ground water pumped by the District is generally of poorer quality (higher salt content and more sodic) than its surface water supply. However, most of the ground water supply is still of good to fair quality for irrigation. The relatively high sodium content of the water has caused infiltration problems in some areas of the District. **Appendix D** includes total dissolved solids measurements for wells in JID from 1977-2009. **Appendix F** includes groundwater quality graphs and a summary of groundwater quality in different regions on JID. In general, groundwater quality is the best in the southern part of JID, and northern parts of the eastside well field, and is worst in the central part of the wellfield. Refer to the groundwater quality maps and tables in **Appendices D** and **F** for more detail.

Oil wells in the area have always brought up brackish water (exceeding 60,000 ppm in salts) with the oil. Prior to the mid-1950's this brackish water was disposed in unlined pits

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and was allowed to percolate into the ground water. This led to degradation of groundwater in the Eastside well field due to disposal of saline waters in the Raisin City Oilfield. Unlined pits are now illegal, and deep well injection is used to dispose of the brackish water.

#### Surface Water Quality

Surface water in JID comes primarily from the Kings River and Delta Mendota Canal (through Fresno Slough and Mendota Pool, respectively). Kings River water is of excellent quality for irrigation. Salt content, measured as total dissolved solids (TDS), typically runs around 50 parts per million (ppm) and boron content is generally less than 0.1 ppm. Infiltration problems sometimes occur due to the purity of the water. Beneficial calcium ions tend to be leached from the soil, reducing permeability. Water supplied from the Delta-Mendota Canal to the District is of good quality for irrigation. TDS for the water is generally around 400 ppm and boron content is typically less than 0.5 ppm.

#### City of San Joaquin

Groundwater quality in the City is very good, possibly as a result of JID importing significant quantities of pure surface water into the area. Surface water treatment is currently limited to wellhead treatment with chlorine. However, the City is concerned about the migration of poorer quality groundwater from outlying areas, and would like to monitor the encroachment of these water sources.

### **3 - BASIN MANAGEMENT OBJECTIVES**

The Plan Participants have adopted the following five Basin Management Objectives:

1. **Stabilize Water Levels.** Stabilize average long-term groundwater levels by 2015 to prevent the loss of groundwater reserves, and prevent the need for well deepening, and reduce the new for installing new wells.
2. **Increase Groundwater Storage.** Increase groundwater storage capabilities through the development of groundwater banking projects including the JID Water Augmentation Project.
3. **Prevent Further Land Subsidence.** Prevent further land subsidence that can cause a reduction in groundwater storage space and damage water infrastructure. Prevent land subsidence caused by groundwater withdrawals through efficient use of groundwater supplies and full utilization of surface supplies.
4. **Prevent Groundwater Degradation.** Prevent groundwater degradation by protecting groundwater through proper well construction and abandonment, proper use of agricultural amendments, importing clean high quality surface water, and preventing intrusion of poor quality groundwater from neighboring areas.
5. **Improve Coordination between the City of San Joaquin and James Irrigation District.** Improve integrated groundwater management between the City and JID through better coordination, data sharing, joint projects, and annual coordination meetings.
6. **Improve Water Conservation.** Improve water conservation as an alternative to developing new water supplies or increased groundwater pumping. Conservation measures include urban and agricultural best management practices such as metering, plumbing retrofits, efficient irrigation systems, and educational programs.
7. **Increase Knowledge of Local Geology and Hydrogeology.** Increase knowledge of the local geology and hydrogeology through technical studies, and subsurface investigations. Gain a better understanding of regional groundwater quality and flow conditions, and potential impacts from surrounding water sources with poor water quality. Seek funding for these investigations through State and Federal grant programs.

More specific goals related to these BMOs are found in following sections. All existing and on-going activities described in Sections 4-9 will be maintained, unless stated

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otherwise. (In Sections 4-9 the Existing Activities are not repeated under Planned Actions, even though they will be continued in the future). All new policies and projects described in Sections 4-9 will be pursued, but their implementation will be subject to available funding and staff time.

## **4 - STAKEHOLDER INVOLVEMENT**

### **4.1 - Groundwater Advisory Committee**

The purpose of a Groundwater Advisory Committee (GAC) is to oversee the creation, updating and implementation of a Groundwater Management Plan. Preferably, the Committee should be comprised of a broad cross section of interests in the Plan Area. James Irrigation District initially invited the public to participate but no local residents expressed interest. JID also invited several local agencies to participate in the Groundwater Advisory Committee but the City of San Joaquin was the only party showing interest. Eventually, JID and the City agreed to jointly prepare a GMP. As a result, both the San Joaquin City Council and JID Board of Directors served as temporary Groundwater Advisory Committees for overseeing the development of the GMP. These two GACs offered several useful and insightful comments that were incorporated into this GMP. After adoption of this GMP, a GAC comprising members of both agencies will be formed to assist with implementing the GMP. The GAC will include two to three members from each agency and will meet annually.

### **Existing Activities**

Assisted with the development of this GMP.

### **Planned Actions**

The Committee will attempt to meet annually, or more frequent if deemed appropriate, and will have the following responsibilities:

- Review trends in groundwater levels and available information on groundwater quality;
- Evaluate the effectiveness of current groundwater management policies and facilities;
- Discuss the need for new groundwater supply/enhancement facilities;
- Educate landowners on groundwater management issues;
- Assess the overall progress in implementing the programs outlined in the Groundwater Management Plan;
- Recommend updates or amendments to the Groundwater Management Plan;
- Identify regional and multi-party groundwater projects; and
- Review and comment on Annual Groundwater Reports.

### **4.2 - Relationships with Other Agencies**

The Plan Area is located in the Kings Groundwater sub-basin and San Joaquin Valley Groundwater basin, which extend beyond many political boundaries and includes other municipalities, irrigation districts, water districts, private water companies, and private water users (see **Figure 2**). This emphasizes the importance of inter-agency cooperation, and the District and City have historically made efforts to work conjunctively with many other water management agencies.



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The City of San Joaquin and James Irrigation District have strengthened their working relationship by collaborating on this GMP and signing a Memorandum of Understanding (MOU). The MOU outlines a plan for the two agencies to share information, meet regularly, and collaborate on groundwater management and water conservation projects (see **Appendix E**).

Below is a list of some other agencies that the District or City have worked with in managing local groundwater resources:

- Kings River Conservation District
- Kings River Water Association
- United States Bureau of Reclamation
- Department of Water Resources
- McMullin Recharge Group
- San Luis and Delta-Mendota Water Authority
- Association of California Water Agencies
- Agricultural Water Management Council
- Tranquillity Irrigation District
- Mid-Valley Water District

Following is a brief discussion on the relationships between these agencies and the Plan Participants.

#### Kings River Conservation District

KRCD is a legislatively defined special district that supports local interests in water planning and management, develops projects, collects groundwater data, and prepares an annual report of groundwater conditions; however, KRCD does not have the legislative authority to manage groundwater. The District has recently passed a resolution in support of the KRCD's *"Lower Kings Basin Groundwater Management Plan Update"*.

#### Kings River Water Association

JID is a member of the Kings River Water Association (KRWA), a 28-member group of water agencies that was formed in 1927 to administer and manage water uses on the Kings River. The benefits of KRWA membership include conflict resolution mechanisms and improved coordination among member agencies. The KRWA opens lines of communication so that members can work together effectively to utilize, trade, and transfer waters from the Kings River.

#### USBR/DWR

JID currently participates in the Semi-annual Groundwater Measurement Program administered by the USBR. This program requires JID to take water level measurements from specified wells two times a year and share the data with USBR. USBR shares this data with the DWR.



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#### McMullin Recharge Group

The McMullin Recharge Group (Group) is comprised of James Irrigation District, Mid-Valley Water District, Raisin City Water District, Tranquillity Irrigation District, Terranova Management Co, LLC., and Kings River Conservation District. The Group works cooperatively to investigate groundwater recharge projects in the area of the McMullin Grade, just east of the James Irrigation District, adjacent to the Eastside Well Field. The group members share information and JID has acquired valuable knowledge of the local geology as a consequence of their participation.

#### San Luis and Delta-Mendota Water Authority

James Irrigation District is a member agency of the San Luis and Delta-Mendota Water Authority (SLDMWA), an umbrella organization for 32 water agencies in the Central Valley. The SLDMWA was established in 1992 and represents approximately 2,100,000 acres of federal and exchange water service contractors within the western San Joaquin Valley, San Benito and Santa Clara Counties. The JID General Manager is on the Board of Directors at SLDMWA and is a member of its Water Resources Committee.

The SLDMWA serves the information and representation needs of its members by developing, providing, and disseminating information to legislative, administrative and judicial bodies concerning a variety of issues such as: Sacramento and San Joaquin Delta exports, water supply, water quality, water development, conservation, distribution, drainage, contractual rights, surface and groundwater management, and any other common interest of the member agencies. The SLDMWA also works with other governmental and public agencies to promote the common welfare of the landowners and member water agencies.

The SLDMWA prepared a regional water management plan in 2005 entitled “*Westside Integrated Water Resources Plan*”. The Plan provides guidance for JID and other water agencies on regional priorities and multi-agency projects.

#### Association of California Water Agencies

JID is an active member of the Association of California Water Agencies (ACWA). ACWA fosters cooperation among all interest groups concerned with stewardship of the state's water resources. JID attends the ACWA annual meeting and benefits from the educational and informational services that ACWA offers.

#### Agricultural Water Management Council

JID is a member of the Agricultural Water Management Council (AWMC or Council). The AWMC was formed in 1996, following the work of an advisory committee formed by Assembly Bill (AB) 3616, Agricultural Efficient Water Management Act of 1990. The

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Council consists of members of the agricultural and environmental communities and other interested parties with the expressed goal for water suppliers to voluntarily develop Water Management Plans and implement Efficient Water Management Practices (EWMPs) to further advance water use efficiency while maintaining and enhancing economic, environmental and social viability and sustainability of soil and crop production. Members sign a Memorandum of Understanding that includes a comprehensive methodology by which each and every Efficient Water Management Practice is analyzed and provides a consistent analysis by all participating water suppliers.

#### Tranquillity Irrigation District

JID had a long-term relationship with the neighboring Tranquillity Irrigation District. The two Districts have collaborated on SCADA monitoring projects in the Fresno Slough, and have discussed developing interties between the districts to provide better service to their growers.

#### Mid-Valley Water District

In 1999 and 2000, the Mid-Valley Water District, with the cooperation of James Irrigation District and Reclamation District No. 1606, evaluated the feasibility of a groundwater recharge basin near the James Bypass between Manning Avenue and American/Placer Avenues.

#### **Existing Activities**

- On-going involvement with the agencies and associations listed above.

#### **Planned Actions**

- When relevant to JID, implement the multi-agency projects identified in the Westside Integrated Water Resources Plan.

#### **4.3 - Plan to Involve the Public and Other Agencies**

The District and City of San Joaquin are already involved with many neighboring and regional agencies on groundwater management projects. Nevertheless, the Plan Participants are always interested in building new relationships with other agencies that share the same groundwater basins, and will also strive to involve the public in groundwater management decisions. Additional cooperative relationships can be achieved through the data sharing, inter-agency committees, interagency meetings, memorandums of understandings, formal agreements, and collaborations on groundwater projects. Furthermore, the development of this integrated GMP will foster cooperation between the City and JID.

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#### **Existing Activities**

- Conducted public hearings to discuss the content of this GMP prior to its adoption.

#### **Planned Actions**

- Hold annual Groundwater Advisory Committee meetings with representatives from JID and the City.
- Provide copies of the JID annual groundwater reports to the public at their request. Notify the public of the availability of the annual reports in the JID District newsletter.
- Publish information on groundwater management accomplishments in the JID newsletter and City website.

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### 5 - MONITORING PROGRAM

This section discusses monitoring of groundwater levels, groundwater quality, land surface subsidence, and surface water. Monitoring is considered critical to future management decisions, and the proposed monitoring program is intended to:

1. Provide warning of potential future problems;
2. Use data gathered to generate information for water resources evaluations;
3. Develop meaningful long-term trends in groundwater characteristics; and
4. Provide data comparable from place to place in the Plan Area.

JID prepared a Groundwater Quality Monitoring and Mitigation Plan in 2010 (see **Appendix F**). The plan includes a discussion on the District's existing groundwater quality, monitoring well network, groundwater level and monitoring program, and recommendations for protecting and mitigating groundwater quality. The plan enhances the discussion provided below on groundwater monitoring in JID.

#### **5.1 - Groundwater Level Monitoring**

The District regularly measures spring and fall water levels in District wells and a few private wells in cooperation with a valley-wide monitoring program coordinated by the USBR and the DWR. In addition, groundwater levels are monitored monthly in some shallow wells. **Figure 3** illustrates the location of wells that are monitored. **Attachment 2** includes a list of attributes for these wells. The City of San Joaquin does not regularly measure groundwater levels in their wells, but relies on the regional data collected by JID. However, the City will be installing three monitoring wells at their wastewater treatment plant in 2010 or 2011, which will be monitored on a regular basis.

The purpose of a groundwater level monitoring program is to provide information that will allow computation of the change in ground water storage. Contour maps depicting groundwater levels in the District and surrounding area will be prepared annually, along with estimates of changes in groundwater storage.

#### **Existing Activities**

- Measurement of groundwater levels in shallow monitor wells each month
- Measurement of groundwater levels each spring and fall in active and abandoned JID production wells
- Share groundwater level data with USBR and DWR

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### **Planned Actions**

- Periodically review the monitoring network to determine if it provides sufficient areal coverage to evaluate groundwater levels.
- Protect wells in monitoring program from being abandoned.
- Encourage landowners and developers to convert unused wells to monitoring wells.
- Prepare annual groundwater reports, which will include groundwater contour maps and detailed evaluations of groundwater level trends (see Section 9.2).
- Work with KRCD in the development of a Kings Basin Groundwater Data Center
- Perform a Well Canvass to collect detailed information and precise coordinates on each production well, monitoring well and abandoned well in the Plan Area (see **Appendix F** for more details on the proposed well canvass).
- Investigate the feasibility of installing a SCADA/telemetry system to monitor and operate production wells in JID. If available seek funding to assist with expenses.

### **5.2 - Groundwater Quality Monitoring**

The City performs groundwater quality monitoring as required by the State of California. JID test each well for electrical conductivity annually and performs agricultural suitability analyses on all new wells.

The aforementioned groundwater quality monitoring efforts have one or more of the following objectives:

- 1) Spatially characterize water quality according to soils, geology, surface water quality, and land use;
- 2) Establish a baseline for future monitoring;
- 3) Compare constituent levels at a specific well over time (i.e. years and decades);
- 4) Determine the extent of groundwater quality problems in specific areas;
- 5) Identify groundwater quality protection and enhancement needs;
- 6) Determine water treatment needs;
- 7) Identify impacts of recharge and banking projects on water quality;
- 8) Identify suitable crop types that are compatible with the water characteristics; and
- 9) Monitor the migration of contaminant plumes.

### **Existing Activities**

- Measure electrical conductivity in JID production wells on an annual basis.
- Perform agricultural suitability analysis on all newly constructed wells.

### **Planned Actions**

- Regularly collect new water quality information from other agencies and review it to identify any impending groundwater quality problems.
- Protect wells in monitoring program from being abandoned.

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- Prepare groundwater quality maps when sufficient information is available with the aid of a qualified hydrogeologist. Attempt to characterize groundwater quality with depth and provide the information to growers so they can use it when designing and installing wells.
- Work with KRCD in the development of a Kings Basin Groundwater Data Center.
- Perform Agricultural Suitability Analysis every 5 years (2015, 2020, 2025, etc.) in selected wells in areas of concern. This will be timed with the submission of 5-Year Water Management Plans to the USBR.
- Test for Additional Constituents in wells near the City of San Joaquin. If funding from the City of San Joaquin is available, perform more detailed water quality sampling in JID wells near the City of San Joaquin. This information could be useful in determining the quality of groundwater that may be migrating toward the City. Constituents that could be tested include arsenic, gross alpha, Total Organic Carbon, and other constituents important to drinking water quality.
- Regularly calibrate the hand-held TDS meter used to test wells each year, to help ensure that measurements are accurate and trends are properly identified.

#### **5.3 - Groundwater Monitoring Protocols**

Monitoring protocols are necessary to ensure consistency in monitoring efforts and are required for monitoring evaluations to be valid. Consistency should be reflected in factors such as location of sample points, sampling procedures, testing procedures, and the time of year when the samples are taken. Without such common ground, comparisons between reports must be carefully considered. Consequently, uniform data gathering procedures will be practiced by the Plan Participants.

The District has developed new water level and water quality monitoring protocols, which can be found in **Appendix G**. The District has also adopted protocols prepared by a local laboratory, Fruit Growers Laboratory of Visalia, California. These are included as **Attachment 4** and supplement the protocols described above. The City has not adopted specific protocols, but will follow JID's protocols until they adopt their own.

#### **Existing Activities**

None

#### **Planned Actions**

- The District will work with KRCD to establish uniform protocols that are used basin wide.
- The City will review JID's protocols and adopt them or develop their own protocols.

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#### **5.4 - Surface Water Monitoring**

Surface water sources in the Plan Area include the Fresno Slough and Fresno Slough Bypass. In addition, the Mendota Pool is located near JID and is a source of surface water.

#### **Existing Activities**

- Monitor flowrates in the Fresno Slough Bypass.
- Monitor surface water quality in the Mendota Pool at P Booster.

#### **Planned Actions**

None

#### **5.5 - Land Surface Subsidence Monitoring**

Land subsidence results from excessive groundwater pumping beneath laterally extensive confining clay layers. The removal of groundwater from a confined aquifer causes increased pressure on the aquifer skeletal system below the confining layer. This causes compaction of the fine-grained layer at depth, and is evident at the ground surface as land subsidence. Land subsidence has been monitored throughout the San Joaquin Valley. The most serious subsidence occurred north of the Districts and monitoring efforts have declined in recent years.

A State-Federal committee on subsidence was formed in the early 1950's and performed research and measured subsidence until 1970. By 1970, 5,200 square miles in the Valley had subsided more than 1 foot. Between 1926 and 1970, a maximum of 28 feet of subsidence was measured at a point southwest of Mendota. The compacting forces caused by groundwater level decline squeezed more than 15.6 million acre-feet of water storage space out of the sediments during the same period. From 1975 to 1992, subsidence occurred mostly in drought years when groundwater pumping replaced unavailable surface water supplies. The Department of Water Resources has continued to measure subsidence along the California Aqueduct in the winter of 1993-1994. Very little quantitative data has been collected since 1970 by others. In neighboring Tranquillity Irrigation District, there is a benchmark on Lift Station No. 1 that is periodically resurveyed to check for land subsidence.

It is likely that some of the local land subsidence has been arrested with the importation of large volumes of surface water since the District established its surface water contracts. However, there is often a time delay in subsidence after groundwater withdrawals, so the Plan Area may still be experiencing residual subsidence. In addition, groundwater levels can drop appreciably in extended droughts, which could also lead to further subsidence. Lands within the Plan Area will be observed for land

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subsidence, and, if land subsidence becomes a problem, this Plan will be amended to include preventative and mitigative measures.

#### **Existing Activities**

None

#### **Planned Actions**

- Periodic resurvey of control points and local benchmarks to check for land subsidence. The control points and local benchmarks will be checked relative to High Precision Geodetic Network benchmarks.



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### **6 - GROUNDWATER RESOURCES PROTECTION**

#### **6.1 - Well Abandonment**

Existing State and Fresno County law requires that owners or lessees properly destroy their abandoned wells. Proper destruction of abandoned wells is necessary to protect groundwater resources as abandoned or improperly destroyed wells can result in water of different chemical qualities from different strata mixing, and useable groundwater being degraded. This is especially important because part of the Plan Area has a confined aquifer.

The administration of a well construction, abandonment and destruction program has been delegated to the Counties by the State legislature. Fresno County has adopted a permitting program consistent with Department of Water Resources Bulletin 74-81 for well construction, abandonment, and destruction.

The Plan Participants will properly abandon their own wells when they are no longer useful. In addition, they will encourage landowners and developers to properly abandon their own wells, or preferably, convert unusable wells to monitoring wells so that they can become a part of JID's groundwater monitoring program.

#### **Existing Activities**

None

#### **Planned Actions**

- When possible, convert unusable production wells to monitoring wells.
- Destroy any District or City owned wells that have no use according to County and State standards.
- Seek funding to perform a survey of all inactive wells and properly abandon those that have no potential for rehabilitation or use them as monitoring wells.

#### **6.2 - Wellhead Protection**

The Federal Wellhead Protection Program was established by Section 1428 of the Safe Drinking Water Act Amendments of 1986. The purpose of the program is to protect groundwater sources of public drinking water supplies from contamination, thereby eliminating the need for costly treatment to meet drinking water standards. The program is based on the concept that the development and application of land use controls, usually applied at the local level in California, and other preventative measures can protect groundwater.

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A Wellhead Protection Area (WHPA), as defined by the 1986 Amendments, is "the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The WHPA may also be the recharge area that provides the water to a well or wellfield. Unlike surface watersheds that can be easily determined from topography, WHPA's can vary in size and shape depending on subsurface geologic conditions, the direction of groundwater flow, pumping rates and aquifer characteristics.

Under the WHPA, States are required to develop an EPA-approved Wellhead Protection Program. To date, California has no state-mandated program, but instead relies on local agencies to plan and implement programs. This is one of the factors that prompted the State Legislature to enact AB 3030. Wellhead Protection Programs are not regulatory in nature, nor do they address specific sources. They are designed to focus on the management of the resource rather than control a limited set of activities or contaminant sources.

Essential to any wellhead protection program are proper well design, construction, and site grading to prevent intrusion of contaminants into the well from surface sources. Wells constructed by the Plan Participants will be designed and constructed in accordance with DWR Bulletin 74-81. In addition, landowners will be encouraged to follow the same standards for privately owned wells. DWR Bulletin 74-81 provides specifications for the following:

- Methods for sealing wells from intrusion of surface contaminants;
- Covering or protecting the boring at the end of each day from potential pollution sources or vandalism;
- Site grading to assure drainage is away from the well head; and
- Set-back requirements from known pollution sources.

#### **Existing Activities**

- Provide wellhead protection on all newly constructed wells according to County and State standards.

#### **Planned Actions**

- Encourage local growers to incorporate proper wellhead protection into all new wells, and retrofit old wells with proper wellhead protection.

### **6.3 - Saline Water Intrusion**

Saline water intrusion is a concern in two portions of the Plan Area. The first is a generalized condition on the west side of JID. The groundwater in the western portion of the District is significantly saltier than in the eastern portion. Additionally, given the

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direction of ground water flow is in a southeasterly direction, this poorer quality water is encroaching on many of the District's wells.

The second area of concern, the Raisin City Oil Field salt plumes, lies outside the District boundaries but affects the District's east-side wellfield. These plumes formed when brines pumped from oil wells were disposed in surface ponds. It is believed that these plumes currently impact JID wells, even though the practices that created them were halted over three decades ago.

Currently, the District strives to prevent the importation of saline surface waters that could ultimately degrade the groundwater. When alternative water sources are available for importation, the District considers not only the cost but also the quality, including salinity, of the water. The District will evaluate all possible alternatives, and, when practical and feasible, select water sources with acceptable levels of salinity.

#### **Existing Activities**

None

#### **Planned Actions**

- Review available water quality data to identify areas with the potential for saline water intrusion.

#### **6.4 - Migration of Contaminated Groundwater**

Ground water contamination can originate from many sources or activities. Groundwater contamination can be human induced or caused by naturally occurring processes and chemicals. Sources of groundwater contamination can include irrigation, dairies, improper application of agricultural chemicals, septic tanks, industrial sources, stormwater runoff, and disposal sites.

Clean-up of contaminated ground water is a complex and expensive task generally involving a number of organizations. Agencies with roles to play in mitigating ground water contamination include the California Regional Water Quality Control Board (RWQCB), the California Department of Toxic Substances Control (DTSC) and the U.S. Environmental Protection Agency (EPA). Each agency has its own set of regulatory authorities and expertise to contribute. The degree to which they participate depends on the nature and magnitude of the problem. If JID or the City identify a ground water contamination problem, they will refer the information to the appropriate regulatory agency.

According to the Lower Kings Basin GMP, the migration of contaminated groundwater is a secondary concern for the area. Contaminated plumes are relatively small and localized in the Lower Kings Basin. Furthermore, the Plan Participants do not know of

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any contaminant plumes in their service area, aside from salinity from the Raisin City Oilfields. Nevertheless, the Plan Participants recognize that migration of contaminated groundwater is always possible. The City and District will continue to monitor groundwater quality and remain cognizant of the possibility of contaminated groundwater migration into the Plan Area.

#### **Existing Activities**

- Regularly review data and reports from regulatory agencies on contaminant plumes to provide warning of potential future problems.
- Construct wells with adequate seals between the formations to prevent the downward migration of poor quality water.

#### **Planned Actions**

- Seek to locate recharge basins next to areas with water quality problems to blend water supplies and create a hydraulic barrier to impede movement of contaminant plumes.

### **6.5 - Groundwater Quality Protection**

The City relies exclusively on groundwater and JID cannot support all of their crop demands with their surface water supplies. Clearly, groundwater is a very important resource in the area. The groundwater, however, will have limited or no use if it has poor quality. Therefore, protecting the quality of the groundwater is a cardinal component of this GMP. Groundwater quality can be protected through proper use of pesticides, herbicides and fertilizers, stormwater quality management, septic system management, and water vulnerability planning and management.

JID has outlined several existing and proposed methods for protecting and mitigating groundwater quality. These are document in their Groundwater Quality Monitoring and Mitigation Plan (**Appendix F**)

#### **Existing Activities**

- Educate staff on proper use of herbicides used in JID canals.

#### **Planned Actions**

- Seek funding to improve security at water facilities and reduce the potential for contamination from acts of vandalism or terrorism.
- Educate growers on the proper use of pesticides, herbicides and fertilizers in the District newsletter.
- Implement groundwater mitigation methods documented in **Appendix F**.

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## 7 - GROUNDWATER SUSTAINABILITY

Between 2000 and 2009, groundwater has comprised about 45% of the water used in JID in a typical year, but has comprised up to 78% of water supplies. During years with low surface water allocations, groundwater is essential to prevent the loss of permanent crops. The City of San Joaquin relies exclusively on groundwater and has no surface water rights or facilities to accept surface water. Therefore, preserving the sustainability of groundwater is essential for the economic well being of the District growers and City residents.

### **7.1 - Issues Impacting Groundwater Sustainability**

The James Irrigation District relies on both surface and groundwater for irrigation demands. **Table 7.1** shows surface and groundwater usage from 2000-2009.

**Table 7.1 – James Irrigation District Surface and Groundwater Use (2000-2009)**

Year	Surface Water		Groundwater	
	Volume (AF)	%	Volume (AF)	%
2009	15,900	22	55,100	78
2008	21,300	27	56,900	73
2007	34,300	42	48,200	58
2006	67,400	91	6,300	9
2005	50,300	69	22,500	31
2004	38,600	47	43,000	53
2003	39,000	51	37,400	49
2002	37,400	43	48,700	57
2001	26,400	35	48,600	65
2000	35,400	49	36,400	51
Avg	36,600	48	40,300	52

Table 7.1 shows that for typical years, groundwater constitutes about 50% of the District's water use. In almost all years the District's surface water supply is fully utilized, and groundwater is pumped to supplement the surface water. Typically, groundwater pumping begins in the middle of the irrigation season and groundwater is often the only water source available at the end of the irrigation season (August to October).

2005 and 2006 were not typical years since flood waters were released down the Kings River. When this was available JID used the flood water instead of their CVP supply,

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and saved their CVP supply for a later date. This permitted for a larger and longer supply of surface water which allowed for decreased groundwater pumping, and groundwater recharge as a result of diverting flood flows. A two year supply of flood water only occurs occasionally and cannot be relied upon.

The District's surface water supplies are sporadic, unreliable and unpredictable. In addition, due to recent regulatory actions, surface water supplies from the Central Valley Project have become less dependable and shortages occur more frequently. This has caused the District's available surface supplies to be reduced causing more reliance on pumping groundwater. Furthermore, the acquisition of new water contracts or substantial water transfers in the future is unlikely. In summary, groundwater supplies are vital to the JID and consequently the District considers the proper management of their groundwater resources to be imperative.

The City of San Joaquin relies exclusively on groundwater. When local and regional groundwater supplies are stressed, such as during droughts, this can impact groundwater supplies in the City. It is unlikely that the City can secure a long-term surface water contract, and therefore they must protect and preserve the local groundwater resources.

#### **7.2 - Overdraft Mitigation**

Overdraft of the groundwater supply can lead to a variety of problems, including subsidence and increased pumping costs. Additionally, if overdraft continues unchecked, the groundwater supply may be unreliable when surface water is scarce, as in a time of extended drought. Groundwater overdraft is considered the principal groundwater problem in the Plan Area.

#### **Groundwater Overdraft Estimates**

JID estimates overdraft using historical groundwater levels during a hydrological base period. This base period must extend for a long enough time that both wet periods and droughts are covered, and the water supply conditions approximate the average. The term overdraft is used here to indicate a long-term water-level decline in an area during an average hydrologic base period. It is not used to describe short-term water-level declines during droughts.

The procedure to estimate overdraft from groundwater levels uses many measurements over a long period of time. In the Plan Area, measurements are made in the winter or early spring, following a period of minimal pumping, and again in the fall, following a period of heavy pumping. The complete water-level data record can be used to prepare well water-level hydrographs and to determine long-term water level changes. A well water-level hydrograph is a plot of depth to water versus time for a particular well.



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After the well water-level hydrographs are prepared, the trends in the water levels in the base period are closely examined. In most agricultural areas the annual low values are in the late summer or early fall, at the end of a long irrigation season, and annual high values are in the winter or early spring, just before pumping begins for the next growing season. Linear regressions are then performed on the data within the base period that appear valid and representative of the water-level conditions. The slope of these "best-fit" lines are then used as the long-term average annual changes in ground water level.

JID calculated overdraft during the period from 1975 to 1993, but has not performed any more recent analyses. The hydrographs created indicate gradual long-term water-level declines in both the District and the east side wellfield for the chosen hydrologic base period. In order to determine the change in ground water storage, a parameter known as the "specific yield" was multiplied by the average water-level change during the period evaluated. Specific yield is the ratio of the volume of water which will drain freely from a material to the total volume of the formation. Based upon estimates of specific yield by the USGS and the DWR, the average specific yield of the unconfined aquifer was estimated to be about eleven percent for the District and about twelve percent for the east side wellfield area. Using these specific yields, the ground water overdraft was calculated to be about 1,000 AF per year for the District, and around 2,700 AF per year for the eastside wellfield for the chosen hydrologic base period.

Overdraft could be a significant concern if the Plan area experiences increased pumping, reduced recharge, and/or increased ground water outflow. Periodic analyses of ground water overdraft, perhaps every five years, are needed to reassess the need for overdraft mitigation.

#### Mitigation Measures

Groundwater overdraft is due to an imbalance in the rates of extractions and replenishment. There are several methods to correct this imbalance. The first is to decrease the extraction to match the rate of replenishment. The second is to increase groundwater replenishment to match the extraction rate. The third method is a combination of the first two, to balance replenishment and extraction. Each of the methods are applied over an extended period, making use of the storage capacity of the aquifer. Extractions can exceed replenishment in drought periods as long as replenishment equally exceeds extractions in wetter periods.

Factors that will affect the future rate of overdraft include surface water supplies available to JID through the Central Valley Project and future water demands in the District.

The District utilizes both surface water and groundwater conjunctively to meet the water needs of its growers. The Plan Participants understand that the existing condition of overdraft is regional in nature and correction and mitigation of the problem will need to be addressed not only by the District and City, but also by neighboring agencies.

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### Groundwater Recharge

Mitigation measures to negate current overdraft and contribute to lessening future overdraft conditions rely on the importation of additional surface supplies. Increasing JID's surface water supply would rely on improving the District's ability to use excess Kings River flows. Flood water appears adequate on the Kings River to mitigate the overdraft condition if sufficient recharge capacity can be developed. JID already recharges water in the K-Basin Recharge Project and plans to recharge additional flood waters with their proposed Water Augmentation Project (see Section 7.4).

Mitigative measures to reduce demands can include conversion to more efficient irrigation systems, and urban conservation measures discussed in Section 7.5. Demand reduction can also be achieved by cropping changes or land fallowing, but these would have adverse economic impacts and therefore are not considered.

### Water Transfers

In 2001 the JID Rules and Regulations were amended to restrict the transfer of surface and groundwater supplies outside of the District. The purpose of this amendment was to prevent further groundwater overdraft. Specifically, the Rules and Regulations state:

*"Any transfer of surface water which is replaced by increased groundwater pumping would therefore exacerbate groundwater overdraft....Similarly, if a Water User were to pump groundwater within the District and export it, the same effect would occur." (pg 8)*

Such exports are only allowed under certain circumstances; for example, surface water exports are allowed if the land that would have used the water is fallowed. Refer to the Rules and Regulations for more details on this policy. Clearly, the District recognizes the gravity of their groundwater overdraft problem and this amendment illustrates their commitment towards preserving their groundwater resources.

### Limitations on Pumping

The California Water Code gives water and irrigation districts the power to limit or suspend groundwater extractions. However, such limits will only be implemented if the Plan Participants determine through study and investigation that groundwater replenishment programs, or other alternative sources of water supply, have proved insufficient or infeasible to lessen impacts to groundwater. In the unlikely event that it becomes necessary to reduce groundwater extractions, the District intends to accomplish such reductions under a voluntary program, which would include suitable incentives to compensate users for reducing their groundwater pumping. The District will not attempt to restrict or otherwise interfere with any landowner or water user exercising a valid right to pump and utilize groundwater.

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### Economic Inducements

The District recognizes that management of water supplies should reflect water conservation and the protection of groundwater resources. The District currently provides an indirect economic inducement by establishing water rates high enough to promote water conservation yet low enough to compete with groundwater pumping costs. This pricing system encourages the use of surface water to meet irrigation demands when available, thereby preserving the underlying groundwater resource.

### **Existing Activities**

- Restrict groundwater exports from the District.
- Set surface water rates low enough to be competitive with groundwater pumping costs.

### **Planned Actions**

- Urban water conservation measures (see Section 7.5)
- Seek funding to prepare a Drought Preparedness Plan that will identify triggers and response measures for droughts.

### **7.3 - Groundwater Replenishment**

Replenishment of ground water is an important technique to manage a groundwater supply and mitigate a condition of overdraft. The estimated overdraft for the Plan Participants and the east side wellfield can probably be offset with recharge projects that would use excess Kings River flows (flood releases from Pine Flat Reservoir).

The types of groundwater replenishment include the following:

- Direct groundwater recharge
- Incidental groundwater recharge
- Injection wells
- In-lieu recharge
- Groundwater banking
- Canal seepage
- Pipeline seepage
- Flood flow seepage
- Deep percolation from precipitation
- Deep percolation from irrigation

**Direct Groundwater Recharge.** Two recharge projects are currently in operation in JID. The first involves the diversion of Kings River flood water from the Fresno Slough Bypass (James Bypass) into basins in the upland areas of the Bypass between the two outer flood channels. The Bypass area has fairly permeable soils and provides a modest opportunity for ground water replenishment. This project may have potential for expansion. The second project includes the 220-acre K-Basin Project. Some of this water is recovered with wells and some of the water remains underground for recharge. The District is also

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developing recharge capability with the Water Augmentation Project, described in Section 7.4

**Incidental Groundwater Recharge.** Incidental groundwater recharge occurs in the three stormwater basins operated by the City of San Joaquin, located at Colorado Avenue, California Avenue and Cherry Lane. Flows to these basins are not measured and there are no current estimates of the volume of incidental recharge.

**Injection Wells.** Injection wells pump water directly into the groundwater basin and are primarily used in urban areas, where land is at a premium. Capital costs are high and include conveyance, treatment and well construction. Some injection well projects have been denied by the Regional Water Quality Control Board due to water quality issues, especially disinfection byproducts in the source water. Given the high cost of injection wells, regulatory hurdles and the presence of more viable and lower costs options for recharging water, this option was removed from further consideration.

**In-lieu recharge.** The District views in-lieu deliveries as the most practical and effective means of groundwater replenishment. In-lieu deliveries, also called indirect deliveries, involve the delivery of surface water to landowners and water users who would otherwise have pumped groundwater, thus leaving water in the aquifer for future use. From 2000 to 2006, JID imported between 26,000 and 67,000 AF/year of surface water, and, as a result, JID is performing a significant amount of in-lieu recharge.

**Groundwater banking.** Groundwater banking agreements often require that a portion of the banked water be left in the aquifer as a payment to the banking agency. JID is planning to develop a groundwater bank through the Water Augmentation Project. Water banking partners will be required to leave 10% of their water behind for District recharge.

**Canal seepage.** Canal seepage in JID is estimated to be about 12,300 AF in a typical year.

**Pipeline Seepage.** Seepage from City of San Joaquin pipelines, and JID's Lateral G pipeline, help to recharge the groundwater. No estimates of the seepage are currently available.

**Flood flow seepage.** Natural seepage occurs in the District from flood flow waters in the Fresno Slough and the James Bypass channel. However, this seepage volume has not been measured or estimated.

**Deep percolation from precipitation.** In JID, deep percolation from normal rainfall events is probably negligible. Some deep percolation occurs during exceptionally long and heavy storms. However, such storms are infrequent.

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**Deep percolation from irrigation.** Deep percolation occurs when some of the water applied for irrigation percolates beyond the crop root zone and accumulates in the aquifer. The extent of deep percolation varies with the irrigation method, irrigation efficiency, and antecedent moisture condition. During 2002 and 2003, deep percolation from local irrigation was estimated to be from 8,000 to 10,000 AF/year, but was only estimated to be about 2,000 AF in 2009.

### Existing Activities

- Groundwater recharge in the 220-acre K-Basin recharge project.
- Groundwater recharge in the Fresno Slough and Fresno Slough Bypass
- Measure the volume of water delivered to groundwater recharge basins.
- Periodically remove sediment and rip the soils in recharge basins to maintain recharge rates.

### Planned Actions

- Work cooperatively to minimize development on lands that are favorable for artificial recharge.
- Design and construct the Water Augmentation Project, which will increase recharge capabilities in the District
- Estimate seepage from City of San Joaquin pipelines either from water balance calculations or through field tests.
- Install staff gauges in City of San Joaquin stormwater basins so incidental recharge can be estimated.

### **7.4 - Conjunctive Use of Water Resources**

Conjunctive use of water is defined as the coordinated use of both subsurface and surface water sources so that the combination will result in optimum benefits. Conjunctive operation of a ground water basin is defined in DWR Bulletin 118-80 as:

*"Operation of a ground water basin in coordination with a surface water reservoir system. The basin is intentionally recharged in years of above average precipitation so ground water can be extracted in years of below average precipitation when surface water supplies are below normal."*

Such management results in the groundwater storage being reduced in dry periods and increased in wetter periods. To avoid a condition of overdraft, replenishment must balance extraction over the long-term.

A conjunctive use program requires:

- A source of surface water in years of high surface water supply.
- Recharge facilities.
- Conveyance facilities to import and export water to and from the ground water storage area.

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- Available storage capacity in the aquifer.
- Extraction facilities.
- Distribution facilities for surface and ground water.

Existing conjunctive use operations can be expanded by adding interconnections and promoting water supply exchanges between districts that allow for more flexibility in the region's water supply. The region's assets of federal, state, and local water supplies, dewatered groundwater storage, numerous interconnected conveyance facilities, and significant irrigation demand make it an ideal location to regulate surface and groundwater supplies conjunctively.

The region must absorb wet year water supplies in order to maintain a reliable and economical water supply. Wet year water is available on short notice and not always at times when the water can be delivered for an irrigation demand. Therefore, it is important that the region work cooperatively to increase its ability to absorb surface water when available. Regional Water Management Plans, including the 'Westside Integrated Water Resources Plan', can help identify viable regional projects.

#### Regional Conjunctive Use Projects

In 2004, JID completed construction of the 220-acre K-Basin Recharge Project. The project includes several wells to recover some of the recharged water.

The JID Water Augmentation Project will include new facilities for storing and recharging water, with the goal of reducing JID's dependence on surface water. The project will include improvements to basins and construction of new recovery wells and conveyance facilities. The project will provide facilities for regulation storage, floodwater storage, groundwater recharge, and groundwater banking. These facilities will be located just north of the James Weir in the Fresno Slough Bypass, about 3 miles southeast of the City of San Joaquin. It is estimated that the project will allow JID to capture and recharge an average of 2,100 AF/year of Kings River floodwater. Five recovery wells will have the capacity to extract 30 AF/day. JID will work with the City in locating the wells and will keep the City apprised of progress on the project. The project is currently being designed and construction is expected to be completed by the end of 2011 or 2012.

JID has also prepared a Water Banking Prospectus for the Water Augmentation Project. JID is actively seeking an agency that wants to bank water in JID using the proposed facilities. As a condition of any banking agreement at least 10% of the banked water must be left behind. This will contribute to local recharge and higher groundwater levels while the water is banked. The volume of water that will be banked still has to be negotiated with a potential banking partner.

One example of a 'regional' groundwater recharge project is the proposed McMullin Group recharge project. This project would use flood flows to recharge the groundwater system. The project, which includes a series of ponds and canals, was investigated and



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a draft feasibility study was completed in April 2000. At that time, two sites in the McMullin Recharge Project area were considered covering 138 acres. With support from DWR grant funding, additional hydrogeologic evaluations have been made of the sites since the completion of the draft feasibility study. In response to interpretation of the hydrogeologic evaluations, several recharge ponds have been proposed for development. These ponds can be operated using available floodwater. This project was identified as a regional goal in the Lower Kings Basin GMP with estimated costs of \$2.2 million and a completion date of 2010.

The City of San Joaquin does not have a surface water supply, but does divert stormwater to basins where some is percolated, thereby recharging the groundwater.

#### **Existing Activities**

- Continue groundwater recharge and banking in the K-Basin Recharge Project.

#### **Planned Actions**

- Support the development of new surface storage and water supply projects that would permit the participants to better utilize surface water supplies.
- Investigate additional groundwater banking projects and facilities.
- When transferring surface water, attempt to transfer it to neighboring agencies so it benefits local groundwater levels.
- Design and construct the JID Water Augmentation Project.
- Construct four production wells in JID as part of a Federal Drought Relief grant.
- Actively recruit regional water agencies to store water in JID's groundwater banking facilities.
- Discuss options with the Fresno Irrigation District to purchase surplus surface water to reduce demand on local groundwater resources.

## **7.5 - Water Conservation and Education**

### **City of San Joaquin**

The City of San Joaquin prepared a Water Conservation Plan in 2009. The plan identified several measures that can help reduce water consumption. The Plan outlined two general conservation strategies:

- 1) **Twenty Percent Reduction in Water Use.** A citywide reduction in water use of 20% by the year 2011 (to mirror the reduction goals of the current California Green Building Standards Code). These savings will be accomplished through equipment upgrades and a targeted education and community outreach program. Showerhead and faucet replacements are planned to be part of the upgrades installed as part of the city's low income housing rehabilitation program. Beginning in the 2010-2011 academic year, students at San Joaquin Elementary school will receive water conservation training.

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- 2) **Water Meters.** Install water meters on all service accounts by the year 2020. California state law requires meters on all service accounts by the year 2025. Installing meters can also lead to reduced water use, and will enable the city to charge residents based on actual water usage. Studies show that cities with metered water use up to 15% less water than cities without meters. When meters are used to institute a tiered pricing structure, another 10% savings occurs. In addition to providing customers with feedback on their consumption levels, service meters in conjunction with supply meters, enable a system to better account for leaks in the system. The guidance from the EPA estimates that by installing meters water use can be reduced by 20%. Currently, only some commercial and industrial accounts are metered. Residential meters are planned for the future as required by the State. In the Water Conservation Plan, meters were not found to be the most economical alternative for conserving water, so the City will seek funding to assist with their purchase and installation.

The City's current ordinance that allows landscape watering only on certain days is also a fairly effective method in preventing over watering. The City will include inserts in water bills reminding residents of these landscape watering rules.

#### James Irrigation District

The District considers water conservation and education important aspects of their overall groundwater management efforts. All water deliveries are metered and billed based on the volume used. Therefore, all customers have an incentive to minimize water usage. Water conservation education is achieved through the annual grower's meeting and district newsletter. JID has also constructed several regulation reservoirs, that help to reduce operational spills and thus conserve water.

#### **Existing Activities**

- JID's monthly water statements include water use information for each customer. In addition, the District maintains historic water use by turnout. This data is available to water users on request as it could be beneficial in making on-farm water management decisions.
- The District holds an annual grower's meeting and publishes a semi-annual newsletter to help educate local growers on important issues such as water conservation and water quality protection.

#### **Planned Actions**

- Evaluate the feasibility of a grey water system in the City of San Joaquin.
- Seek funding to install water meters in the City of San Joaquin
- Implement the City of San Joaquin's water conservation education program.

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#### **7.6 - Water Recycling**

The City does not currently recycle any of their water. Wastewater effluent is currently discharged to aerated lagoons at the western end of JID for evaporation and percolation. The annual volume of water treated is about 121 million gallons. The City plans to improve their wastewater treatment system to include advanced secondary treatment with activated sludge, nitrogen removal, and sludge handling. Construction of the new facilities is expected in 2010 or 2011. The effluent will have better quality that is suitable for non-edible crops. The City has held discussions with farmers to use the effluent, and also plans to meet with JID to discuss delivery of the water into the JID distribution system. No other urban agencies are located in the area that could feasibly deliver recycled water to the Plan Area.

The City has noticed some high salt contents in their wastewater. They are investigating whether a commercial or industrial entity is dumping wastewater with high salt loads.

#### **Existing Activities**

None

#### **Planned Actions**

- Remain cognizant of opportunities to purchase recycled water from other municipalities.
- Hold a joint meeting with the City and JID to discuss beneficial use of recycled WWTP water on JID crops. Discuss the merits of performing a feasibility study on importing recycled water to JID.
- Investigate the source of saline water in the San Joaquin wastewater.

## **8 - GROUNDWATER OPERATIONS**

### **8.1 - Well Construction Policies**

Proper well construction is important to ensure reliability, longevity, and protection of groundwater resources from contamination. Department of Water Resources Bulletin 74-81 provides useful guidelines for the construction of groundwater wells. In addition, Fresno County has enacted and is responsible for enforcing a County Well Ordinance that regulates well construction. Proper wellhead protection is essential to ensure that contaminants do not inadvertently enter a well. Well construction policies that are intended to ensure proper wellhead protection are discussed in Section 6.2 – Wellhead Protection.

In addition, the following quality assurance procedures will be followed when constructing District or City owned wells. Landowners are also encouraged to follow these procedures when constructing private wells:

1. Well construction will be performed under contract by a licensed and experienced well driller, in accordance with specifications prepared by a licensed engineer or geologist, and reviewed by legal counsel.
2. A licensed engineer or geologist will oversee construction of the wells.
3. A licensed land surveyor will oversee survey of any newly constructed wells.
4. Wells will be constructed according to guidelines in DWR Bulletin 74-81.

### **Existing Activities**

- Construct wells according to DWR Bulletin 74-81.
- Construct wells using qualified and licensed contractors, engineers, geologists and land surveyors.
- Use plastic well casings in areas where the groundwater and soils are highly corrosive.

### **Planned Actions**

None

### **8.2 - Operation of Facilities**

The City currently has three production wells but has an immediate need for one more wells due to the age and condition of their current wells (the three wells are 10, 30 and 40 years old). The City is concerned about how they will pay for a new well and are seeking funding opportunities.

The City will be installing three monitoring wells at the water treatment plant expansion in 2010 or 2011. The wells are expected to have depths ranging from 50 to 80 feet deep.

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Groundwater facilities in JID include the K-Basin Recharge Project, about 65 extraction wells and about 20 monitoring wells. Proper construction, operation, and maintenance of these groundwater facilities is an important part of groundwater management.

The District normally constructs two new irrigation supply wells each year and subsequently retires two older wells that have a combination of the lowest efficiencies and poorest water quality. This helps to ensure the District's water reliability (by retiring older wells), and ensuring higher water quality. This also expands the grid of available testing points.

JID will also strive to provide the best facilities for delivery of surface water supplies, since they are used conjunctively with groundwater. JID realizes that the success of conjunctive use programs is often contingent on the quality of surface water conveyance systems.

#### **Existing Activities**

- Development of a groundwater bank as part of the JID Water Augmentation Project
- Maintenance and upgrading of conveyance facilities for capacity and stability.
- Maintenance of recharge facilities including de-vegetation, disking, deep ripping, and de-silting, as necessary to improve recharge potential.
- Replace at least two wells each year to help ensure the wells are efficient and have suitable water quality.

#### **Planned Actions**

None

## **9 - GROUNDWATER PLANNING AND MANAGEMENT**

### **9.1 – Land-Use Planning**

An important component of developing a Groundwater Management Plan is the review of land-use plans for the surrounding area or basin, and coordinating efforts with regional and local land-use planning agencies. Land-use planning activities in unincorporated areas of Fresno County are performed by the County of Fresno's Department of Public Works planning department, and overseen by the Fresno County Planning Commission. Responsibility for land-use planning in incorporated areas lies with each city's planning staff. The City of San Joaquin is the only urban development within the Plan Area, and its staff is responsible for land-use planning within its Sphere of Influence.

The intent of this Plan is not to dictate land-use planning policies, but rather to establish some land-use planning goals that can aid in protecting and preserving groundwater resources. The Plan Participants will comment on environmental documents for land-use related activities that may impact groundwater. They will also work cooperatively with other agencies to minimize adverse impacts to groundwater supplies and quality as a result of proposed land-use changes. Some specific land-use planning goals include: (1) preserving areas with high groundwater recharge potential for recharge activities; (2) protecting areas sensitive to groundwater contamination; (3) requiring hydrogeologic investigations, water master plans, and proven and sustainable water supplies for all new developments; and (4) requiring appropriate mitigation for any adverse impacts that land-use changes have on groundwater resources.

### **Existing Activities**

- Notify residents and agencies of projects that have the potential to impact groundwater within their sphere of influence.
- When appropriate, comment on environmental documents and land-use plans that have the potential to impact groundwater.

### **Planned Actions**

None

### **9.2 - Groundwater Reports**

The City of San Joaquin has not historically prepared Annual Groundwater Reports, primarily due to their small size, limited water use, limited water supply data, and lack of available staff. However the City plans to improve groundwater monitoring and data collection, and develop an outline for a brief groundwater report or groundwater memorandum consistent with their needs. This groundwater memorandum will be completed prior to the Annual Groundwater Advisory Committee meeting and used during discussions with JID. The City will consider preparing a comprehensive Groundwater Report as they expand.



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JID has a goal to prepare groundwater reports every year to document groundwater levels, available groundwater storage, historical trends, and other important groundwater related topics. This information will be used to forecast future problems, plan future groundwater projects, and develop new groundwater policies. The annual report will cover the prior calendar year and will be completed each year by April 30<sup>th</sup>. See **Attachment 5** for a report outline.

### Existing Activities

- JID prepares a Water Management Plan every five years for the United States Bureau of Reclamation as a requirement to maintain their Central Valley Project water supply. The Water Management Plan includes sections on groundwater usage and groundwater projects.

### Planned Actions

- Prepare an annual Groundwater Memorandum documenting the City's groundwater efforts and statistics including groundwater pumping, well construction, groundwater studies, groundwater quality data, and other pertinent information. As the City expands their groundwater monitoring and management efforts, the memorandum would evolve into an annual report as described below for JID.
- Prepare an annual JID Groundwater Report that will include the following:
  1. Groundwater level data;
  2. Groundwater contour maps and groundwater flow directions;
  3. Groundwater storage calculations;
  4. Evaluation of one-year and five-year historical trends in groundwater levels, contours, and storage, and perceived reasons for any changes;
  5. Evaluate the adequacy of monitoring efforts and monitoring protocols.
  6. Estimates of deliveries to recharge basins;
  7. Summary of important groundwater management actions;
  8. Discussion on whether management actions are meeting the management objectives;
  9. Summary of proposed management actions for the future;
  10. Summary of groundwater related actions taken by other regional groups;
  11. Recommendations for changes in the content or format of the annual report;
  12. Recommendations for updates to the GMP.

### **9.3 - Plan Implementation**

Implementation of this updated GMP is expected to result in significant amounts of new knowledge and an achievable improvement in groundwater management in JID and the City of San Joaquin. **Attachment 6** includes an implementation schedule for this GMP from 2010-2015. The schedule does not include existing activities that will be continued, but rather documents new projects.

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The goals listed in this GMP are considered reasonable and within the capabilities of the District and City. However, most of the goals will require some funding or staff time to achieve. Since staff time and funding are only available in finite quantities, and can often fluctuate, the Plan Participants must by necessity prioritize efforts and cannot guarantee that all of the goals will be accomplished. The Plan Participants recognizes the importance of groundwater management, and will make their best efforts to meet the goals outlined in this plan. If staff or funds are limited, then the projects in the implementation schedule will be prioritized. Plan implementation for the City will rely largely on grant funding.

### **9.4 - Plan Re-evaluation**

The Groundwater Advisory Committee will be responsible for monitoring the progress in implementing the GMP objectives. Refer to Section 4.1 for more information on the membership, policies, and procedures of the Committee. The Committee will attempt to meet at least once a year to review and evaluate groundwater conditions as well as evaluate the effectiveness of the GMP. As new policies, practices, and ordinances become necessary or desirable to enhance the management of the local groundwater supply, this Plan will be amended as necessary.

### **Existing Activities**

None

### **Planned Actions**

- Update the GMP at least every five years, or more frequently if deemed appropriate.
- Evaluate the effectiveness of the GMP and need for an update at the annual Groundwater Advisory Committee meetings.
- Document recommendations for improving or updating the GMP in each annual Groundwater Report.

### **9.5 - Dispute Resolution**

Dispute resolution is addressed in JID through the District's *Rules and Regulations Governing Water Distribution and Canal Maintenance* as follows:

*“When Landowners/Water Users cannot resolve differences or controversies with the Ditchtender, the Superintendent or Assistant Superintendent, they are expected to discuss the problem with the Manager prior to asking the Board of Directors for final determination. Unresolved disputes must be presented in writing to the Board of Directors. The Board of Directors will take no action until a written complaint is received. The Board of Directors reserves the authority to act as the final level of appeal on differences and controversies between Water Users and District employees.” (pg 9-10)*

If necessary, the District Manager may also use legal counsel or technical consultants to assist in addressing disputes. In addition, the Districts participation in numerous multi-agency organizations (see Section 4.2 - Relationships with Other Agencies)

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provides several forums and dispute resolution mechanisms when issues arise between different agencies. No groundwater disputes have occurred in JID in recent years.

The City of San Joaquin does not have special procedures for groundwater disputes, but rather they would be handled through standard dispute resolution processes. These would involve contacting the Department of Public Works, and if necessary meeting with the City Manager or the City Council.

Several mechanisms are also available for resolving regional groundwater disputes through agencies such as KRCD, KRWA, and SLDMWA. The Lower Kings Basin Groundwater Management Plan Update also includes a discussion on the resolution of regional groundwater disputes.

#### **Existing Activities**

- Resolve groundwater disputes through general dispute resolution procedures.

#### **Planned Actions**

- Discuss issues of concern at the annual GAC meetings in an effort to prevent future disputes.

### **9.6 - Program Funding and Fees**

Several alternatives are available to the City and JID for funding groundwater projects, and are described below:

#### **Water Replenishment Fees**

Under AB3030, local agencies have the authority to limit groundwater extractions and implement water replenishment fees based upon the amount of water extracted (extraction based fees must first be approved by majority vote of impacted landowners). Inherent in these powers is the authority to implement metering of private wells. These are considered measures of last resort and the Plan Participants will make any and all efforts to ensure the private, non-metered use of groundwater by the local growers.

#### **Capital Improvement Fees**

The District has the authority to finance capital improvement projects and collect repayment charges from the benefited parties. This process would require a favorable vote from the constituency, and is considered a realistic alternative for large capital projects, such as groundwater recharge or banking projects. The City also has several mechanisms to finance long-term capital projects, and collect revenue through water user fees.

#### **Grants and Loans**

The Plan Participants will pursue available grants and low-interest loans from the Department of Water Resources as well as other State and Federal agencies. The District and City will also seek opportunities to jointly submit grant and loan applications.

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### **James Irrigation District and the City of San Joaquin**

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The District and City realizes that funding from State and Federal agencies for groundwater projects will be partially based on their progress in implementing this GMP.

#### Groundwater Banking Fees

JID is currently developing a groundwater bank that will be partially used to store water for other agencies. The revenue generated from operating the bank could be reinvested into other groundwater projects.

#### Other Revenue Sources

Groundwater projects can also be financed through water user fees and assessments that are collected regularly from all landowners.

#### **Exiting Activities**

- Regularly research grant and loan opportunities from the State and Federal government.

#### **Planned Actions**

- Identify beneficial groundwater projects that become economically feasible when costs are shared among two or more participants.
- Seek funding for projects that could benefit both the City and District.

# Groundwater Management Plan

## James Irrigation District and the City of San Joaquin

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## Groundwater Management Plan

### James Irrigation District and the City of San Joaquin

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## Groundwater Management Plan

### James Irrigation District and the City of San Joaquin

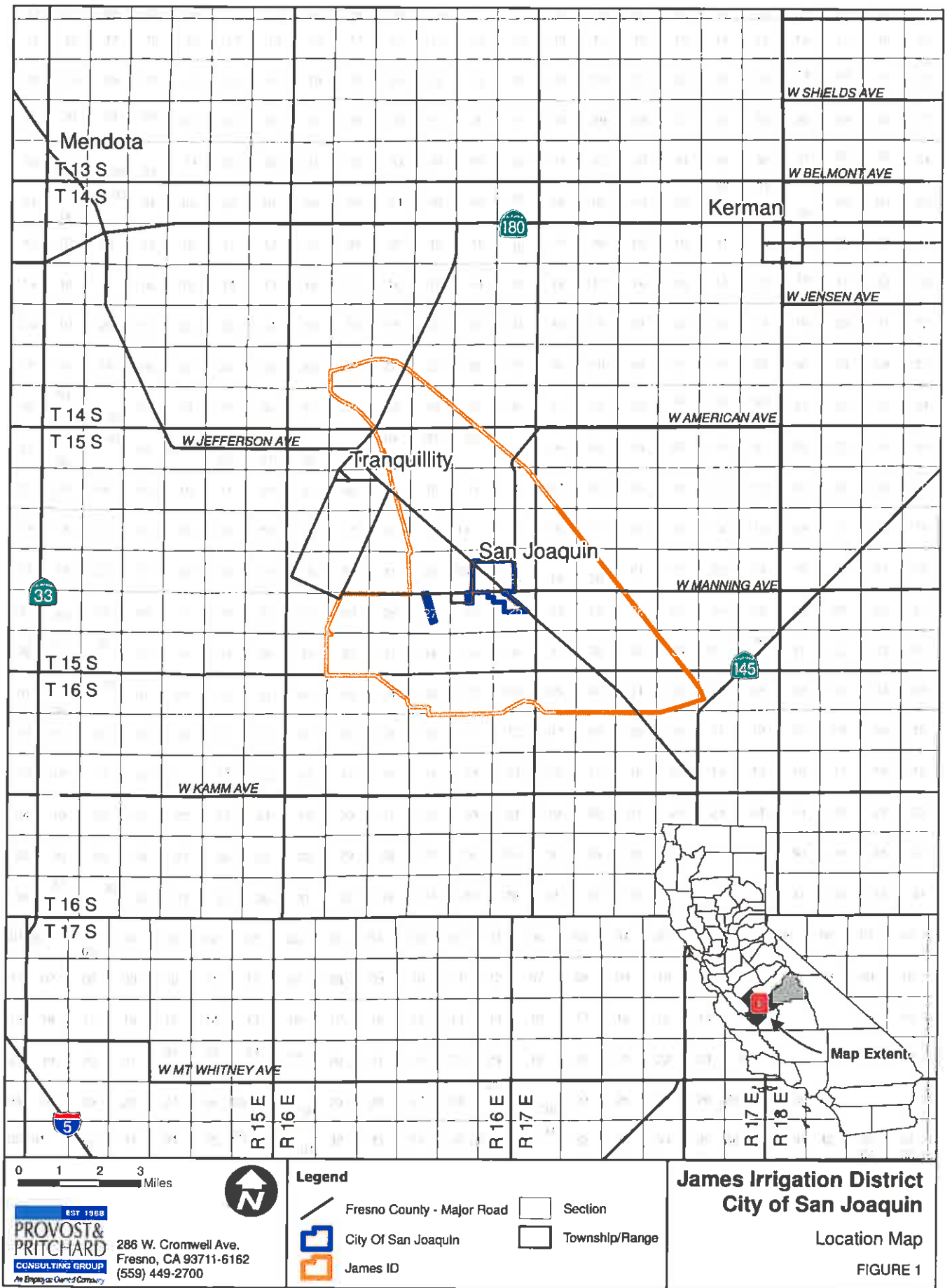
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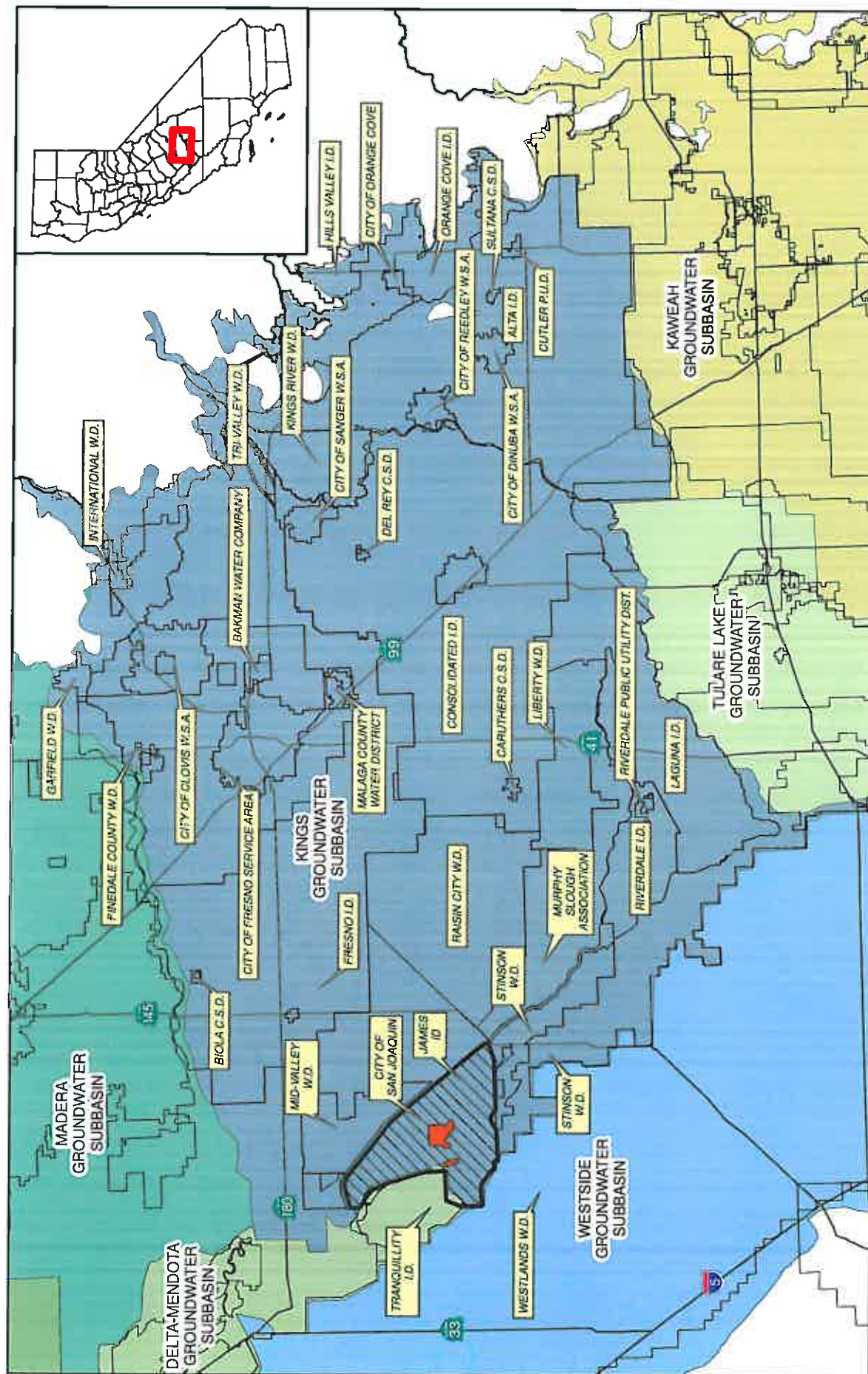
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JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***FIGURES AND ATTACHMENTS***





# James Irrigation District City of San Joaquin Groundwater Subbasins

FIGURE 2

**Legend**

- Water District Boundary
- City of San Joaquin
- James ID

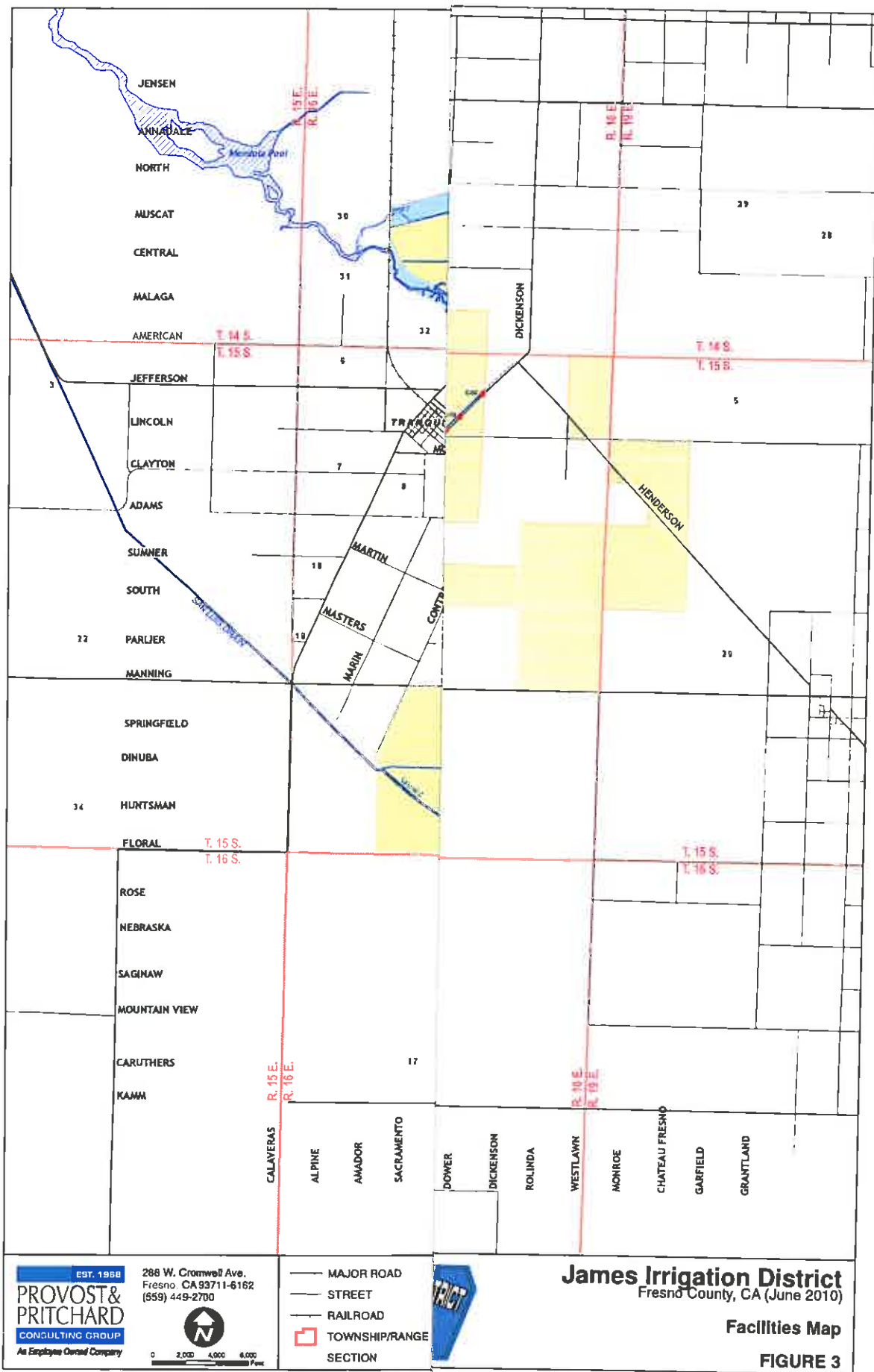
Source: California Department of Water Resources Bulletin 118,  
California's Groundwater Update 2003

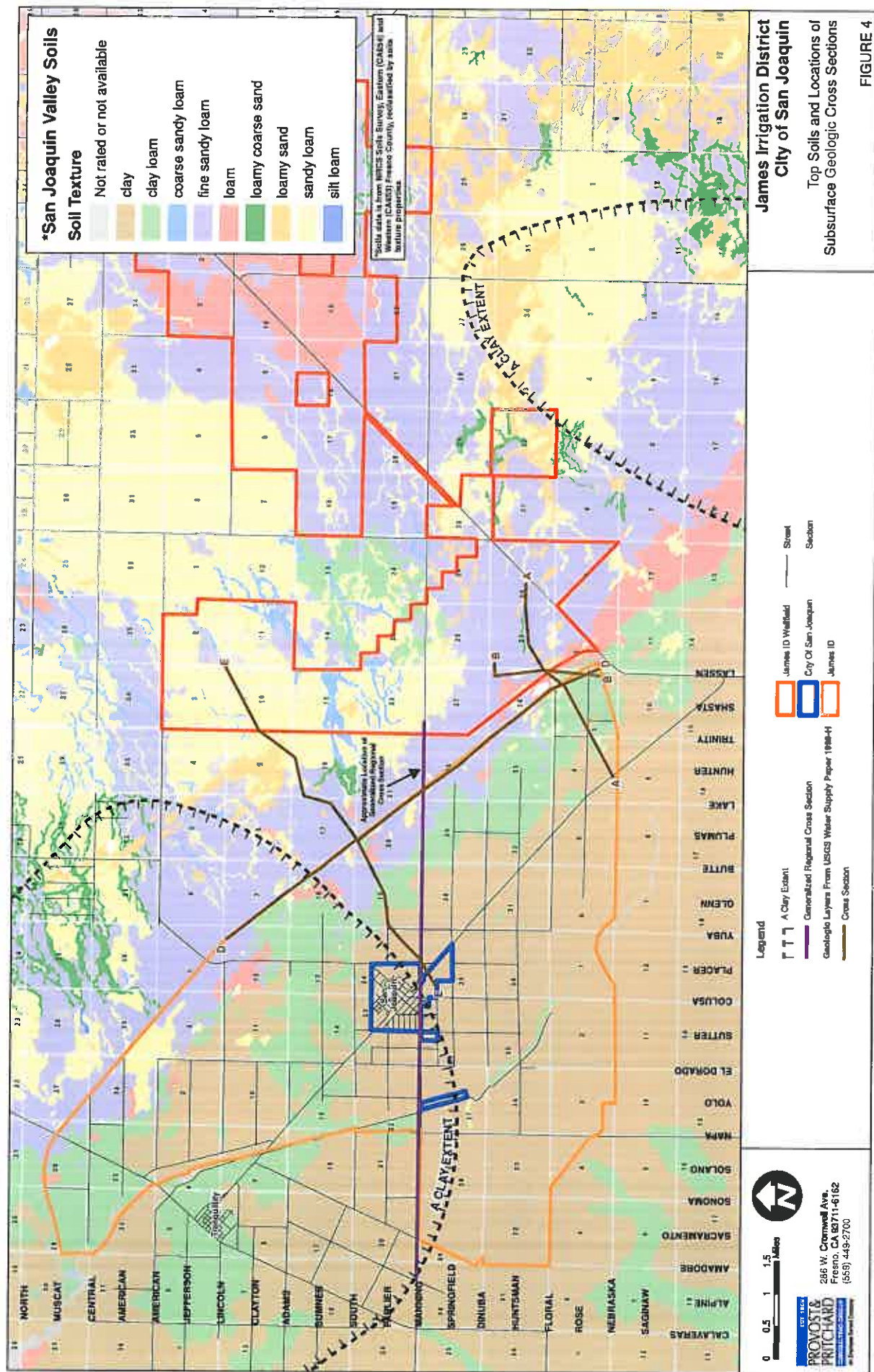
**PROVOST & PRITCHARD**  
CONSULTING GROUP  
451 1500

285 W. Cromwell Ave.  
Fresno, CA 93711-6162  
(559) 449-2700

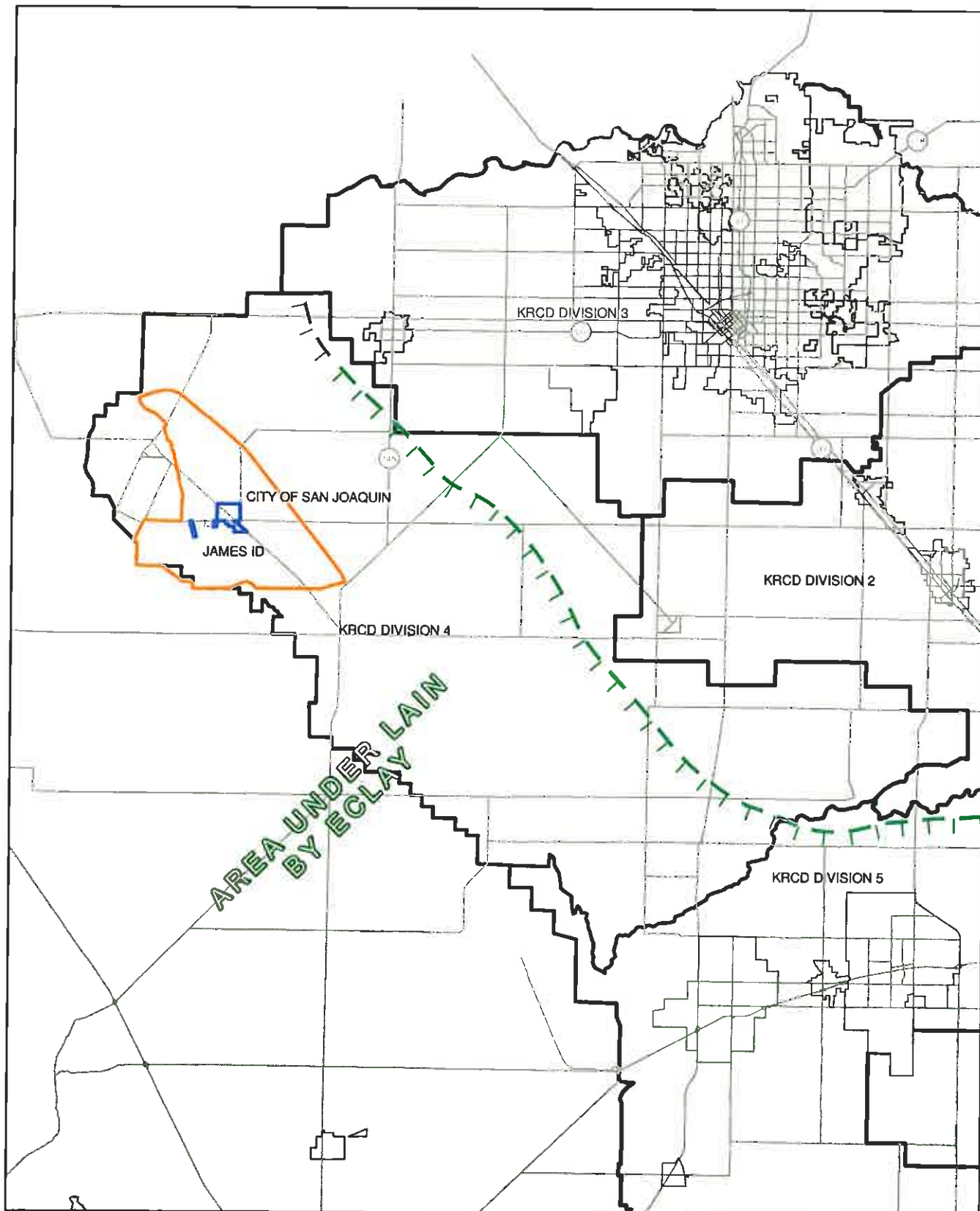
8/5/2010 \\evolution\ev\_clients\James ID-1051\Project\105108C1-AB303 Study\GISMap\groundwaterbasins\_revised.mxd











0 1 2 3 4 Miles



EST 1968  
**PROVOST & PRITCHARD**  
CONSULTING GROUP  
An Employee Owned Company

286 W. Cromwell Ave.  
Fresno, CA 93711-6162  
(559) 449-2700

#### Legend

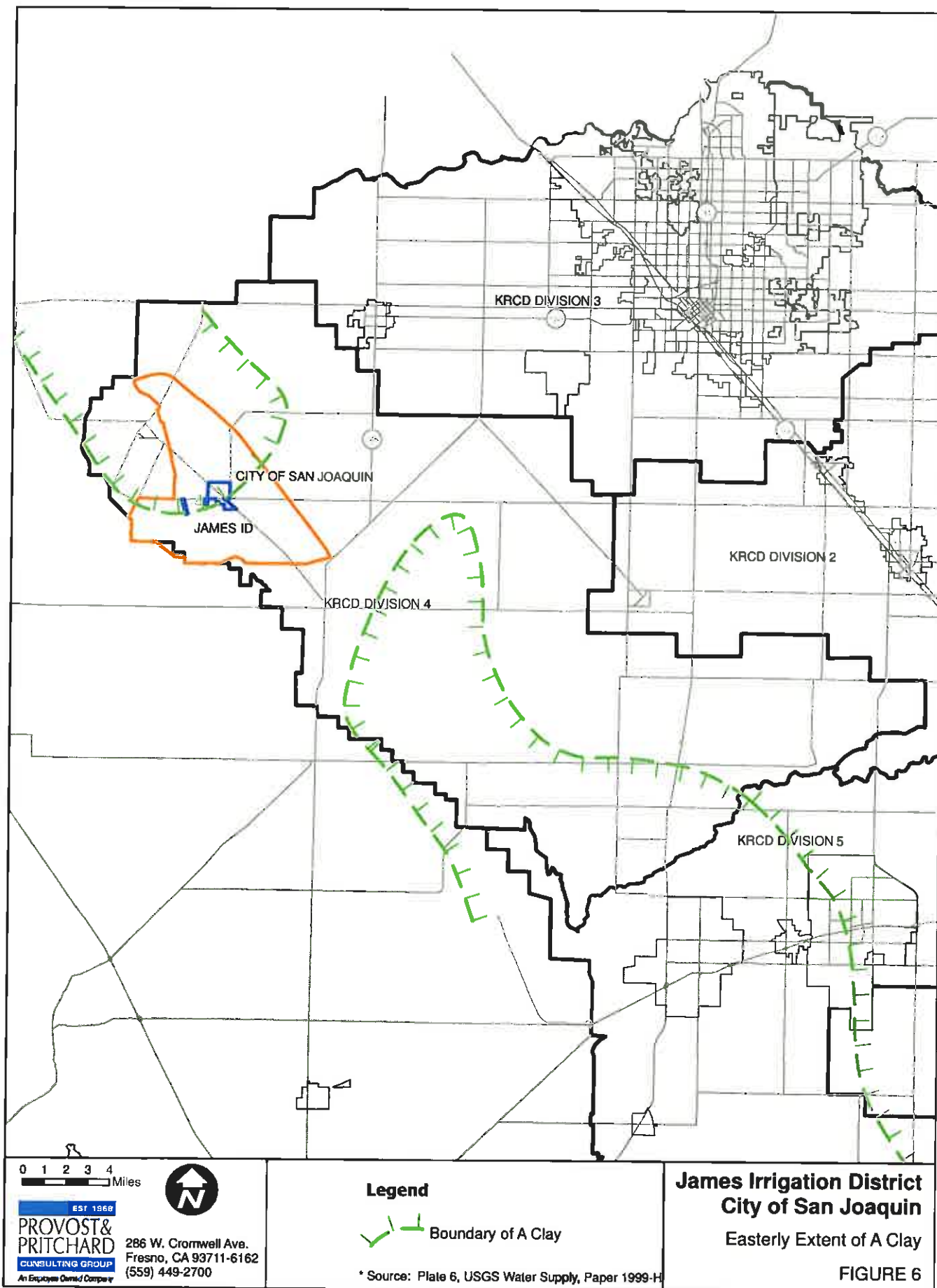
Boundary of E Clay

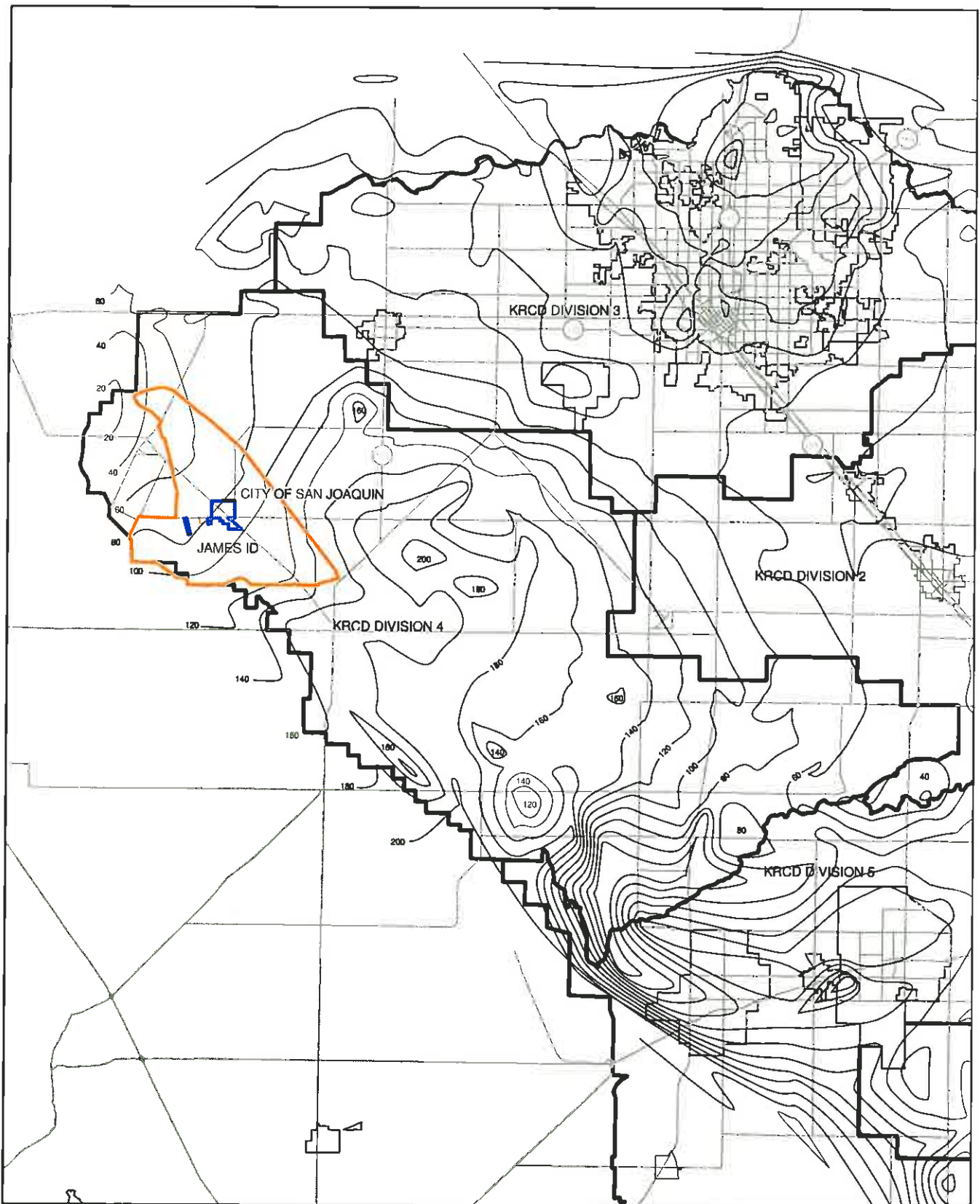
\* Source: Plate 4, USGS Water Supply, Paper 1999-H

**James Irrigation District**  
**City of San Joaquin**

Easterly Extent of E Clay

**FIGURE 5**





0 1 2 3 4 Miles



EST. 1968  
**PROVOST & PRITCHARD**  
 CONSULTING GROUP  
 An Employee-Owned Company

286 W. Cromwell Ave.  
 Fresno, CA 93711-6162  
 (559) 449-2700

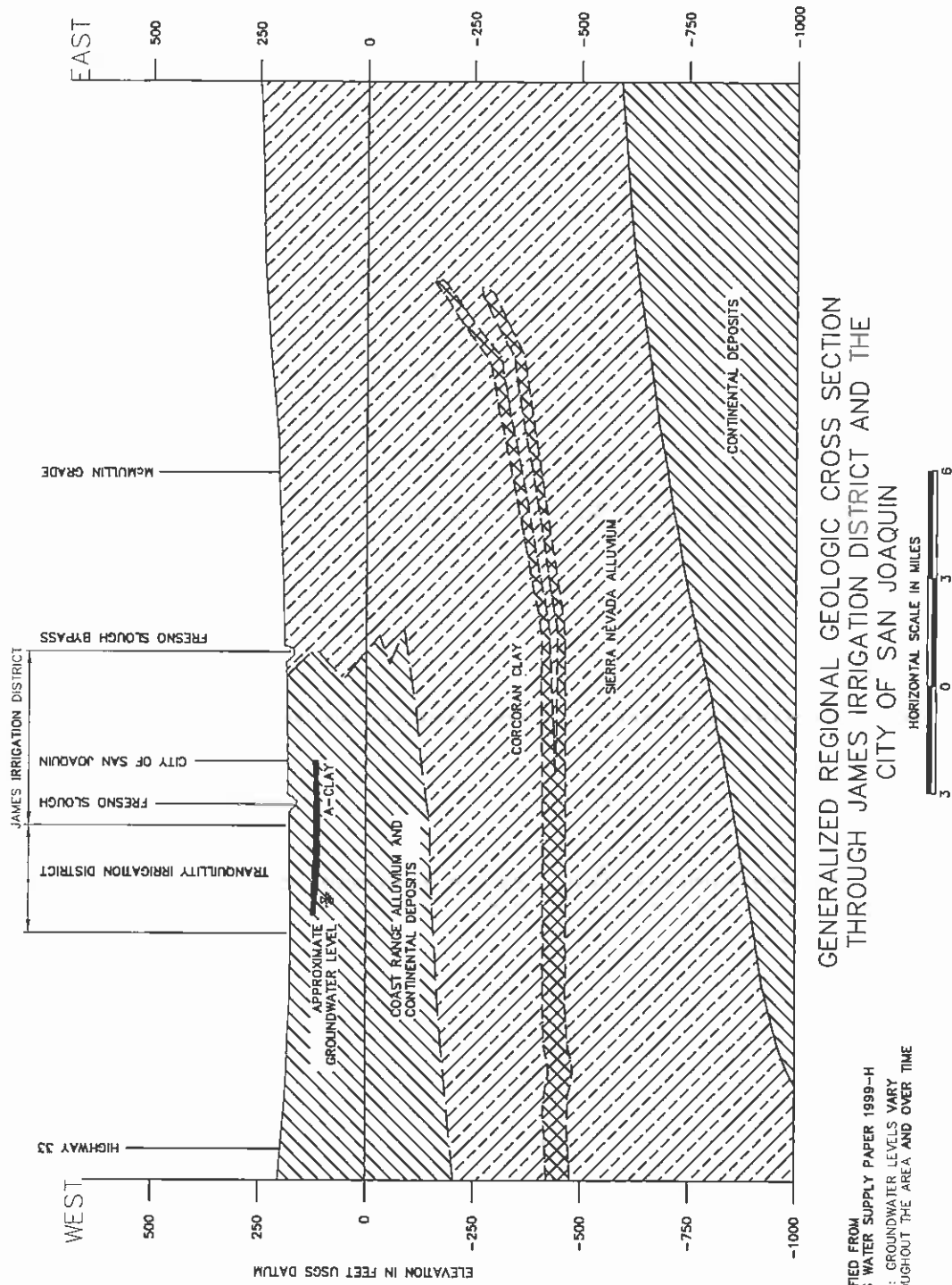
### Legend

— Line of Equal Depth (ft)

\* Source: Figure 3, 2001-2003 Groundwater Report,  
 Kings River Conservation District, Feb. 2004

**James Irrigation District**  
**City of San Joaquin**  
 Regional Groundwater Contours 2003  
 Depth To Groundwater  
**FIGURE 7**

**FIGURE 8**



**GENERALIZED REGIONAL GEOLOGIC CROSS SECTION  
THROUGH JAMES IRRIGATION DISTRICT AND THE  
CITY OF SAN JOAQUIN**

MODIFIED FROM  
USGS WATER SUPPLY PAPER 1999-H  
NOTE: GROUNDWATER LEVELS VARY  
THROUGHOUT THE AREA AND OVER TIME

## CROP ACREAGE HISTORY

CATEGORY: CROP	2009 ACRES	2008 ACRES	2007 ACRES	2006 ACRES	2005 ACRES	2004 ACRES	2003 ACRES	2002 ACRES	2001 ACRES	2000 ACRES	1999 ACRES	1998*(2) ACRES	1997 ACRES	1996 ACRES	1995 ACRES	1994 ACRES	1993 ACRES	HISTORICAL AVERAGE
FIELD: COTTON	5,814	6,550	11,090	12,683	14,321	14,390	12,766	12,648	13,135	10,707	10,896	10,541	14,905	15,761	15,200	13,755	14,173	12,314
FIELD: SUGAR BEETS		548	795	764	504	237	399	574	264	381	734	382	219	90	449	920	589	491
FRUITS: POMEGRANATES	597	526	514	157														449
GRAIN: BARLEY	112	114	171	137	161	213	214	144	0	12	0	0	100	134	380	426	296	154
GRAIN: CORN / HUMAN CONSUMPTION	225	1,676	2,039	119	1,099	1,051	932	1,021	74	119	195	0	0	0	0	0	0	503
GRAIN: OATS						100	230	281	90	0	0	0	0	0	43	247	0	83
GRAIN: WHEAT	1,378	1,947	801	328	671	952	3,029	1,024	764	212	691	583	184	462	109	275	426	814
GRAPES: WINE / BEARING	1,253	1,253	1,253	1,253	721	458	383	383	383	383	382	190	114	114	114	114	114	521
GRAPES: WINE / NON-BEARING						150	0	0	0	0	0	192	268	86	0	0	0	58
HAY: ALFALFA	151	108	190	40	165	84	147	448	876	140	120	120	56	126	69	147	165	185
HAY: BARLEY			0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	1
HAY: GRASS (Var. Love)	56		48		56	0	0	0	0	0	0	0	0	0	0	0	0	11
HAY: GRASS (Var. Sudan)		160			80	80	0	0	0	0	0	260	0	0	0	0	0	44
HAY: OAT	38	8	92	92		64	262	575	280	216	111	103	53	0	0	0	0	118
MELONS: CANTALOUPE						0	0	0	0	5	0	375	65	0	0	60	424	77
MELONS: HONEYDEW						0	0	0	0	0	140	0	0	0	0	0	0	16
NUTS: ALMONDS / BEARING	2,428	2,320	2,108	1,886	1,514	991	615	842	438	695	635	280	80	40	40	20	20	880
NUTS: ALMONDS / NON-BEARING						179	320	37	367	138	134	240	360	400	140	20	20	196
PASTURE (PERMANENT)	58	58	14	15	16	10	16	11	7	11	11	5	9	63	59	68	69	29
SEED: ALFALFA	6,005	4,099	3,127	2,604	2,407	2,321	1,772	2,256	4,632	6,942	8,194	7,405	5,568	5,320	5,663	5,562	5,116	4,647
SEED: BROCCOLI				54	54	0	0	0	0	0	0	0	0	0	0	0	0	8
SEED: CARROT					12	12	0	0	0	0	0	0	0	0	0	0	0	2
SEED: CORN	30	16	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
SEED: LETTUCE	115	13	37	38	38	42	40	39	0	42	36	75	0	0	0	0	0	30
SEED: MUSTARD		1		26	51	25	0	0	0	5	0	0	0	0	0	0	0	7
SEED: ONION	2	2																2
SEED: RADISH				5	5													5
SEED: SPINACH (Var. Komatsuna)				8	8													8
SEED: SUDAN GRASS						0	0	156	0	0	0	0	0	0	0	0	0	13
SILEAGE: CORN	773	2,320	254	499	573	410	351	640	391	269	264	764	431	167	173	186	230	511
SILEAGE: OATS	80					321	0	0	0	0	0	0	0	0	0	0	0	31
SILEAGE: WHEAT	48	160	148	140	142	69	0	0	0	25	57	0	0	0	0	0	0	46
TREES: EUCALYPTUS	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
VEG: ONIONS/DEHYDRATED	333	401	523	504	486	226	145	144	0	0	0	0	0	0	0	0	0	162
VEG: SQUASH	7																	7
VEG: TOMATOES (CANNING)	2,938	1,796	844	570	703	801	820	1,240	902	2,185	1,250	1,133	673	586	608	620	514	1,070
TOTAL	22,442	24,077	24,183	21,923	23,788	23,187	22,442	22,464	22,804	22,488	23,883	22,881	23,143	23,350	23,048	22,421	22,188	22,864
SET-ASIDE																		0
FALLOW / IDLE, IRRIGATED	504	62	306	1,811	187	178	362	369	290	40	187	0	14	0	0	1,008	0	302
FALLOW, GRAZED																		0
LESS MULTIPLE CROPS	-174	-1,304	-1,383	-824	0	-1,046	-319	-821	-388	-278	-426	-193	-327	-117	-43	-580	-185	-498
GRAND TOTAL	22,772	22,835	23,086	22,810	23,976	22,317	22,478	22,832	22,808	22,260	23,854	22,488	22,830	23,233	23,005	22,824	22,001	22,762

\*(1) 1998 - INCLUDES ADJUSTMENT (131.24) ACFT / ALMONDS FOR ERRONEOUS METER READINGS/PRIOR YEAR

\*(2) 1999 - COTTON: ABANDONED 402 ACRES

JAMES IRRIGATION DISTRICT  
SUMMARY OF PRODUCTION WELL ATTRIBUTES

ATTACHMENT 2

Well No.	Type	State ID #	Location	Casing Diameter (in)	Depth (ft)	Perforated Interval (ft)	Date Constructed	Capacity (gpm)	Notes
C-49	Agricultural		Coalinga Alignment (McMullin Grade)						ABANDONED
C-53	Agricultural		Coalinga Alignment (McMullin Grade)						ABANDONED
C-54	Agricultural		Coalinga Alignment (McMullin Grade)						ABANDONED
C-55	Agricultural		Main Canal Alignment	16	500	275 to 496	*	1621	DIFFICULT TO READ
C-56	Agricultural		Main Canal Alignment	18	484	218 to 478	6/12/1959	1661	
C-57	Agricultural	15/18-30F2	Coalinga Alignment (McMullin Grade)	16	365	167 to 361	3/16/1960	-	MULTIPLE C-57S
C-58	Agricultural	15/17-2	Kerman Alignment (Lassen Avenue)	16	382	148 to 376	6/5/1960	1786	
C-59	Agricultural	15/17-23	Kerman Alignment (Lassen Avenue)	16	416	154 to 408	11/29/1960	-	Abandoned as of 2008
C-60	Agricultural	15/17-3	Kerman Alignment (Lassen Avenue)	16	405	148 to 400	2/16/1961	1490	
C-61	Agricultural	15/18-10	Coalinga Alignment (McMullin Grade)	16	418	163 to *	2-8-*	1190	
C-62	Agricultural	15/17-14	Kerman Alignment (Lassen Avenue)	16	430	168 to 410 to 427	6/18/1962	1197	
C-63	Agricultural	15/17-34	Main Canal Alignment	16	477	220 to 470	4/31/1963	-	ABANDONED
C-64	Agricultural	15/16-2	Main Canal Alignment	16	492	212 to 485	6/20/1963	-	ABANDONED
C-65	Agricultural	15/16-1	Main Canal Alignment	16	496	200 to 488	7/6/1961	1032	
C-66	Agricultural		Main Canal Alignment						ABANDONED
C-67	Agricultural	15/17-3	Kerman Alignment (Lassen Avenue)	16	414	200 to 400	2/3/1966	926	
C-68	Agricultural	15/16-12	Main Canal Alignment	16	494	250 to 488	6/9/1967	1149	
C-69	Agricultural	15/18-10	Coalinga Alignment (McMullin Grade)	16	417	200 to 411	1/22/1963	975	
C-70	Agricultural	15/18-30	Coalinga Alignment (McMullin Grade)	16	458	230 to 452	4/28/1969	1225	
C-71	Agricultural	15/18-20	Coalinga Alignment (McMullin Grade)	16	422	230 to 415	6/25/1969	1110	
C-72	Agricultural	15/18-16	Coalinga Alignment (McMullin Grade)	16	424	230 to 404, 412 to 418	12/9/1969	1491	
C-73	Agricultural	15/17-28D	Main Canal Alignment	16	490	250 to 284, 308 to 484	4/24/1972	1362	
C-74	Agricultural		Coalinga Alignment (McMullin Grade)	16	442	235 to 437	5/9/1972	1470	
C-75	Agricultural	15/16-12	Main Canal Alignment	16	499	250 to 494	5/30/1972	-	
C-76	Agricultural	16/17-3	Main Canal Alignment	16 @ 0 to 386.14 @ 315 to 515	515	260 to 300, 330 to 511	5/24/1974	1058	
C-77	Agricultural	15/18-16	Coalinga Alignment (McMullin Grade)	16	458	245 to 454	6/21/1974	1311	
C-78	Agricultural	15/18-2	Coalinga Alignment (McMullin Grade)	16	518	280 to 345, 375 to 512	12/20/1976	1906	
C-79	Agricultural	15/17-96A	Coalinga Alignment (McMullin Grade)	16		250 to 520, 520 to 528	12/16/1979	1454	
C-80	Agricultural		Coalinga Alignment (McMullin Grade)	16	576	250 to 504	3/17/1981	2086	



JAMES IRRIGATION DISTRICT  
SUMMARY OF PRODUCTION WELL ATTRIBUTES

ATTACHMENT 2

Well No.	Type	State ID #	Location	Casing Diameter (in)	Depth (ft)	Perforated Interval (ft)	Date Constructed	Capacity (gpm)	Notes
C-81	Agricultural	15/17-7	Main Canal Alignment	16	504	250 to 500 270 to 287, 292 to 302; 310 to 322; 330 to 380; 384 to 420; 434 to 464; 506 to 524	3/30/1982	1655	
C-82	Agricultural	15/17-36L	Coalinga Alignment (McMullin Grade)	16	533		11/16/1989	1379	
C-83	Agricultural	15/18-2	Coalinga Alignment (McMullin Grade)	16	511	253 to 265; 280 to 300; 324 to 350; 360 to 370; 380 to 422; 446 to 450; 470 to 500	4/19/1997	2008	
C-84	Agricultural	15/17-26	Kerman Alignment (Lassen Avenue)	16	500	340 to 476	4/29/1998	1670	
C-85	Agricultural	15/18-30	Coalinga Alignment (McMullin Grade)	16	532	340 to 320; 370 to 520	6/17/1998	1430	
C-86	Agricultural	15/16-36	Main Canal Alignment	16	500	330 to 420	5/24/2000	1211	Abandoned in 2010
C-87	Agricultural	15/17-7	Main Canal Alignment	16	492	330 to 484	10/25/2001	1391	
C-88	Agricultural	15/18-10	Coalinga Alignment (McMullin Grade)	16	500	335 to 406; 424 to 460; 480 to 490	10/29/2002	1419	
C-89	Agricultural	15/18-10	Coalinga Alignment (McMullin Grade)	16	500	300 to 306; 326 to 335; 368 to 376; 398 to 448; 469 to 483	7/19/2003	-	
D-04	Agricultural		Main Canal Alignment						ABANDONED
D-06	Agricultural		Kerman Alignment (Lassen Avenue)						ABANDONED
D-08	Agricultural	-	Main Canal Alignment	-	-	-	-	-	LIMITED LOG INFO
D-09	Agricultural		Main Canal Alignment						ABANDONED
D-10	Agricultural	15/17-28	Main Canal Alignment	18	808	208 to 808	1948	-	LIMITED LOG INFO
D-15	Agricultural	-	Main Canal Alignment	-	-	-	3/16/1950	-	LIMITED LOG INFO
D-16	Agricultural	-	Kerman Alignment (Lassen Avenue)	16	811	257-807	3/14/1952	-	ABANDONED
D-17	Agricultural		Kerman Alignment (Lassen Avenue)						ABANDONED
D-21	Agricultural		Main Canal Alignment						ABANDONED
D-22	Agricultural		Kerman Alignment (Lassen Avenue)						ABANDONED
D-23	Agricultural		Kerman Alignment (Lassen Avenue)						ABANDONED
D-24	Agricultural	-	Main Canal Alignment						MISSING
D-25	Agricultural		Main Canal Alignment						ABANDONED
D-29	Agricultural	-	Main Canal Alignment						MISSING
D-30	Agricultural	16/17-3	Main Canal Alignment	16	550	240 to 540	4/28/1972	1390	
D-31	Agricultural	15/17-35N	Kerman Alignment (Lassen Avenue)	16	520	240 to 510	4/18/1977	1345	

## ATTACHMENT 2

Well No.	Type	State ID #	Location	Casing Diameter (in)	Depth (ft)	Perforated Interval (ft)	Date Constructed	Capacity (gpm)	Notes
D-32	Agricultural	15/17-35K	Coalinga Alignment (McMullin Grade)	16	525	270 to 510	9/15/1977	1399	
D-33	Agricultural	15/18-30	Coalinga Alignment (McMullin Grade)	16	495	270 to 480	9/17/1977	950	
D-34	Agricultural	15/17-36F	Coalinga Alignment (McMullin Grade)	16	575	270 to 540	11/17/1978	971	
D-35	Agricultural	15/17-35J	Coalinga Alignment (McMullin Grade)	16	550	270 to 540	1/24/1979	1267	
D-36	Agricultural	15/18-10	Coalinga Alignment (McMullin Grade)	16	543	270 to 540	2/2/1980	-	
D-37	Agricultural	-	Inside JID Boundary	16	520	270 to 480	11/13/1980	-	
D-38	Agricultural	15/16-1	Main Canal Alignment	16	515	270 to 510	11/12/1981	1157	
D-39	Agricultural	15/16-1	Main Canal Alignment	16	525	240 to 480	11/7/1984	1008	
D-40	Agricultural	15/17-20	Main Canal Alignment	16	525	270 to 510	5/3/1985	1349	
D-41	Agricultural	15/17-22	Kerman Alignment (Lassen Avenue)	16	520	270 to 510	4/30/1987	1319	
D-42	Agricultural	15/17-10	Kerman Alignment (Lassen Avenue)	16	520	270 to 510	5/9/1987	1343	
D-43	Agricultural	15/17-27	Kerman Alignment (Lassen Avenue)	16	525	270 to 510	5/20/1987	1199	
D-44	Agricultural	16/16-1	Inside JID Boundary	16	520	240 to 510	4/29/1989	-	ABANDONED
D-45	Agricultural	15/16	Inside JID Boundary	16	495	240 to 480	5/25/1990	-	ABANDONED
D-46	Agricultural	16/17-9	Inside JID Boundary	16	540	280 to 520	4/3/1991	-	
D-47	Agricultural	15/16-36	Inside JID Boundary	16	538	280 to 520	4/12/1991	-	
D-48	Agricultural	15/17-34	Main Canal Alignment	18	480	240 to 480	5/15/1992	1470	
D-49	Agricultural	15/17-27	Kerman Alignment (Lassen Avenue)	18	480	240 to 480	-	1355	Date Completed not given. Date of permit is 12/1/92
D-50	Agricultural	15/17-35D	Kerman Alignment (Lassen Avenue)	18	480	240 to 480	12/23/1992	1590	
D-51	Agricultural	15/16-20	Coalinga Alignment (McMullin Grade)	16	500	240 to 500	1/28/1994	1754	
D-52	Agricultural	15/17-22	Kerman Alignment (Lassen Avenue)	16	500	260 to 500	2/7/1995	1465	
D-53	Agricultural	-	Coalinga Alignment (McMullin Grade)	-	-	-	-	1625	No Info
D-54	Agricultural	15/17-34	Main Canal Alignment	16	480	240 to 480	7/12/1996	1248	
D-55	Agricultural	7/16/1996	Main Canal Alignment	16	480	240 to 480	7/16/1996	1523	
D-56	Agricultural	15/16-36	Inside JID Boundary	16	520	260 to 520	6/22/2000	-	
D-57	Agricultural	15/17-2	Kerman Alignment (Lassen Avenue)	16	520	280 to 520	3/24/2004	1750	
D-58	Agricultural	15/17-28	Main Canal Alignment	16	520	280 to 520	6/23/2005	2103	

\*Note 1: San Joaquin Riparian: FEB-JUN Schedule must be taken by June 30; JUL-SEP / Fixed Schedule must be taken by September 30; JAN, OCT-DEC No Deliveries  
 \*Note 2: USBR CVP Contract Total Entitlement allocation reflects 14-month period  
 \*Note 3: Mendota Pool Received: Includes 6% loss

---

## **Sampling Instructions for Aqueous Samples**

FGL provides the appropriate containers, labels, chain of custodies, ice chests and blue ice at no charge. All samples should be cooled to approximately 4° C prior to shipping to the laboratory. A list of proper holding times and preservation techniques is available upon request. **If you have any questions concerning the containers or sampling techniques please call.** Please do not rinse out containers provided by FGL prior to filling. The containers are labeled as to the type of sampling.

### **Type 1 - Semi-volatile Organics, Inorganics, and Radio Chemistry (except Radon):**

- 1) Fill the sample container to the top and cap.

### **Type 2 - Volatile Organics:**

- 1) Fill the sample containers (two VOA vials) until there is a raised portion of water above the rim of the vial and cap carefully. It helps to run the water very slowly.
- 2) After capping, invert the sample vial, tap the vial, then check for bubbles (headspace).
- 3) If bubbles are present repeat sampling until no bubbles are observed. Having no headspace is very important to the overall quality of the analytical results.

### **Type 3 - Bacteriology:**

#### **Source sampling (testing the well) -**

- 1) Selecting a spigot closest to the well and run the water for approximately 5 minutes. If only air is vented, turn on spigots after the holding tank to drop the holding tank pressure which should turn on the pump. The well pump should turn on and run through at least one cycle.
- 2) If the spigot is not frequently used it should be flamed with a propane torch or wiped with bleach and run the water again for 1 minute (longer for very contaminated spigots).
- 3) Please take care opening the sample container and do not remove the powder or pill inside. Permit only the water sample to contact the inside of the bottle and cap.
- 4) Fill the sample container to slightly more than the 100 mL line. This will insure adequate sample volume and enough headspace for mixing.
- 5) Because the analysis needs to be started as soon as possible (maximum time is 30 hours). Please keep the samples cool and ship or deliver to the lab as soon as possible.

#### **System sampling (testing plumbing and faucets away from the well) -**

- 1) If possible, select a tap in frequent use. If the tap has an aerator screen it will need to be removed.
  - 2) Turn on the faucet and allow the water to run for approximately 5 minutes.
  - 3) If the spigot is not frequently used it should be flamed with a propane torch or wiped with bleach and run the water again for 1 minute (longer for very contaminated spigots).
  - 4) Please take care opening the sample container and do not remove the powder or pill inside. Permit only the water sample to contact the inside of the bottle and cap.
  - 5) Fill the sample container to slightly more than the 100 mL line. This will insure adequate sample volume and enough headspace for mixing.
  - 6) Because the analysis needs to be started as soon as possible (maximum time is 30 hours). Please keep the samples cool and ship or deliver to the lab as soon as possible.
-

**Reservoir and stream sampling -**

- 1) Tilt the bottle approximately 45 degrees and hold at the base. In a scooping motion, move the bottle away from you, mouth first, as you fill the bottle.
- 2) Please take care opening the sample container. Permit only the water sample to contact the inside of the bottle and cap.
- 3) Fill the sample container to slightly more than the 100 mL line. This will insure adequate sample volume and enough headspace for mixing.
- 4) Because the holding time is 30 hours please ship or deliver to the lab as soon as possible.

**Type 4 - Radon:**

Radon is a gas and emanates quickly from agitated water. The hold time for regulated water is 4days. (8d for non-Reg.) Proper collection techniques and handling of the Radon sample is critical for valid data to be obtained. For best results follow the instructions listed below:

- 1) Sample by slowly run water from a hose into a 2 liter container until it overflows for 5 minutes. The water entering the container should be as free as possible of bubbles.
- 2) Fill 2 x 125 mL Boston round or 2 x 40 mL VOA vials under water by placing the hose into the bottle, taking care to release all of the air bubbles. Cap tightly under water.
- 3) Take the sample from container and turn it upside down to check for bubbles. If necessary, repeat sampling until no bubbles are observed.
- 4) Dry sample container and place electrical tape around cap.
- 5) Record time and date of the duplicate samples.
- 6) Pack in a cool ice chest and ship NEXT DAY AIR to the laboratory for analysis.

**Other considerations for proper sampling:**

- Make an accurate record on the chain of custody of every sample collected. Identify every container by attaching an appropriately inscribed tag or label which corresponds to the record on the chain of custody.
- Before collecting samples from a distribution system, be sure to flush lines sufficiently to insure that the sample is representative of the supply.
- Before sampling from a well, be sure to run the pump long enough to insure that the sample represents the groundwater source.
- When samples are collected from a river or stream, analytical values may vary with depth, stream flow, and distance from shore and channel width. If equipment is available, take and "integrated" sample from top to bottom in the middle of the stream in such a way that the sample is composited according to time or flow. If only a grab or catch sample can be collected, take it in the middle of the stream and, if possible, at mid-depth.
- Lakes and reservoirs are subject to considerable variations from normal influences such as seasonal stratification, rainfall, runoff, and wind. Choose the location, depth and frequency of sampling based on local conditions and the purpose of the investigation. Avoid surface scum.

**Well Cleanup Procedure for Bacterial Contamination:**

- FGL has a written procedure to help you through the well cleanup process. Please call to obtain a copy of this procedure.

# JAMES IRRIGATION DISTRICT ANNUAL GROUNDWATER REPORT

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- 3.6 - Regional Groundwater Management

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**James Irrigation District and City of San Joaquin  
Groundwater Management Plan  
Implementation Schedule (2010-2015)**

Task No.	Task <sup>1</sup>	2010				2011				2012				2013				2014				2015			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4				
James Irrigation District																									
1	Prepare Annual Groundwater Reports																								
2	Well Canvass																								
3	Well SCADA/Telemetry																								
4	Water Augmentation Project																								
5	Federal Drought Relief Well Construction																								
6	Construct Replacement Wells																								
7	Well Abandonment Program																								
8	Recruit Groundwater Banking Partner																								
9	Negotiate Surface Water Purchases with Fresno Irrigation District																								
10	Evaluate Feasibility of Purchasing Wastewater Effluent from Fresno																								
11	Drought Preparedness Plan																								
City of San Joaquin																									
12	Seek Funding for Water Meters, a New Production Well and Storage Tank																								
13	Water Meter Installation																								
14	Construct 0.7 MG Storage Tank																								
15	Construct New Production Eell																								
16	Update Groundwater Management Plan																								

Notes:

- 1 - Only proposed new projects are shown in this schedule. Existing and on-going projects are not shown. Also, new policies and guidelines that will be implemented on a continuous basis are not shown.
- 2 - Implementation of these projects will depend on the results of current feasibility studies and the availability of funding.

JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***APPENDIX A***  
***PUBLIC PARTICIPATION***

## **RESOLUTION 2010-05**

**RESOLUTION  
OF THE  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT  
TO ADOPT A GROUNDWATER MANAGEMENT PLAN**

At a meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT, a public Irrigation District organized and existing under the Irrigation District Law (California Water Code, Division 11, Section 20,500 *et seq.*) of the State of California, held on the 19<sup>th</sup> day of October, 2010, the following resolution was adopted:

WHEREAS, the California Water code permits the adoption and implementation of Groundwater Management Plans to encourage authorized local agencies to manage groundwater resources within their service areas; and

WHEREAS, the JAMES IRRIGATION DISTRICT (JID) and CITY OF SAN JOAQUIN (CITY) have entered a Memorandum of Understanding (MOU) to improve coordination of water management activities in their local area;

WHEREAS, in accordance with the MOU, JID and the CITY have collaborated in the preparation of an integrated Groundwater Management Plan; and

WHEREAS, adoption of a Groundwater Management Plan is in furtherance of and consistent with the District's goals and objectives and will be in the best interests of the District's landowners and water users; and

WHEREAS, a public hearing was held on October 12, 2010, to consider adoption of the Groundwater Management Plan which is attached as Exhibit A and incorporated herein by reference;

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the JAMES IRRIGATION DISTRICT as follows: The Groundwater Management Plan prepared in compliance with Senate Bill No. 1938 and attached as Exhibit A is hereby adopted.


The foregoing Resolution was introduced and adopted at a Regular Meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT conducted October 19<sup>th</sup>, 2010, on motion of Director Kenneth Hale, and seconded by Director Thomas Chaney, was hereby authorized by the following vote, to wit:

AYES:	5	(Hale, Chaney, Ayerza, Motte, Carvalho)
NOES:	0	
ABSTAIN:	0	
EXCUSED:	0	
ABSENT:	0	



Michael A. Carvalho, President  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

ATTEST:



Donna Y. Hanneman, Secretary  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

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CERTIFICATION OF SECRETARY

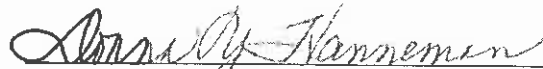
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The undersigned certifies that she is the Secretary of JAMES IRRIGATION DISTRICT and that the foregoing Resolution was adopted by the Board of Directors of said District at a meeting thereof, duly and regularly held on October 19<sup>th</sup>, 2010, at which meeting a quorum of the Board of Directors was at all times present and acting.

IN WITNESS WHEREOF, I have set my hand and seal of the Board of Directors this 19<sup>th</sup> day of October, 2010

{ SEAL }



Donna Y. Hanneman, Secretary  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

**RESOLUTION NO. 10-38**

**RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SAN JOAQUIN  
ADOPTING A GROUNDWATER MANAGEMENT PLAN**

**WHEREAS**, the California Water Code permits the adoption and implementation of Groundwater Management Plans to encourage authorized local agencies to manage groundwater resources within their services areas; and

**WHEREAS**, the City of San Joaquin and the James Irrigation District (JID) have entered a Memorandum of Understanding (MOU) to improve coordination of water management activities in their local area;

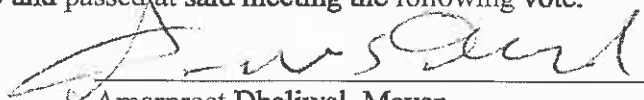
**WHEREAS**, in accordance with the MOU, the City and JID have collaborated in the preparation of an integrated Groundwater Management Plan; and

**WHEREAS**, adoption of a Groundwater Management Plan is in furtherance of an consistent with the City's goals and objectives and will be in the best interests of the City's landowners and water users; and

**WHEREAS**, a public hearing was held on October 13, 2010, to consider adoption of the Groundwater Management Plan, this is attached as Exhibit A and incorporated herein by reference;

**NOW THEREFORE BE IT RESOLVED**, by the City council of the City of San Joaquin as follow: The Groundwater Management Plan prepared in compliance with Senate Bill No. 1938 and attached as "Exhibit A" is hereby adopted.

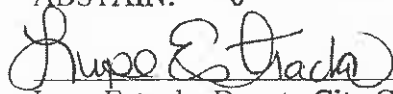
The foregoing resolution was adopted at a special meeting of the City Council of the City of San Joaquin the 13<sup>th</sup> Day of October 2010 and passed at said meeting the following vote:

  
Amarpreet Dhaliwal, Mayor

**ATTEST:**

I Lupe Estrada, Deputy City Clerk of the City of San Joaquin, do hereby certify that the foregoing resolution was duly adopted and passed by the City Council at a special Council, held at the San Joaquin Council Chambers on October 13, 2010, by the following vote:

AYES:       -3-     Hernandez, Lua, Vallejo  
NOES:       -0-  
ABSENT:    -2-     Dhaliwal, Reynaga  
ABSTAIN:   -0-

  
\_\_\_\_\_  
Lupe Estrada, Deputy City Clerk  
City of San Joaquin



**WEST SIDE ADVANCE**

14693 W. Whitesbridge Ave.

P.O. Box 336

Kerman, CA 93630

Telephone: 559-846-6689

This space is for the County Clerk's Filing Stamp

**PROOF OF PUBLICATION**

(2015.5 C.C.P.)

STATE OF CALIFORNIA

County of Fresno,

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the **West Side Advance**, a newspaper of general circulation, printed and published weekly in the City of Kerman, County of Fresno, and which newspaper has been advertised a newspaper of general circulation by the Superior Court of the County of Fresno, State of California, under the date of February 9, 1956, Case Number 45745; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following date, to-wit:

September 29, Oct. 6

all in the year 20 10. I Certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Kerman, California this 6<sup>th</sup>

day of October, 20 10

Kathy A. Matthe  
Signature

Proof of Publication

Notice of Hearing

**NOTICE OF HEARINGS TO ADOPT AN INTEGRATED GROUNDWATER MANAGEMENT PLAN FOR THE JAMES IRRIGATION DISTRICT AND CITY OF SAN JOAQUIN**

**NOTICE IS HEREBY GIVEN** that public hearings will be held at the James Irrigation District Office and the City of San Joaquin Veterans Memorial Hall to consider adoption of an Integrated Groundwater Management Plan to be in compliance with California Senate Bill No. 1938.

The hearing for James Irrigation District will be held at James Irrigation District office, 8749 9th Street, San Joaquin, CA 93660 on October 12, 2010 at 10:00 a.m. The hearing for the City of San Joaquin will be held at the City of San Joaquin Veterans Memorial Hall, 22001 Manning Avenue, San Joaquin, CA 93660 on October 13, 2010 at 6:00 p.m. or as soon thereafter as may be heard.

Part 2.75 of Division 6 of the California Water Code permits the adoption and implementation of Groundwater Management Plans to encourage authorized local agencies to manage groundwater resources within their service areas.

Property owners within the James Irrigation District, property owners and residents of San Joaquin, and other interested parties are invited to attend the hearings. Copies of

the Groundwater Management Plan and a proposed resolution to adopt it will be available for review by the public at the hearings or may be viewed before the hearings at the San Joaquin City Hall or James Irrigation District office. Members of the public will have an opportunity to ask questions and to provide input at the hearings.

John Mallyon  
James Irrigation District  
Manager  
Cruz Ramos  
City of San Joaquin City  
Manager  
3916-w39-40c

**WEST SIDE ADVANCE**

14693 W. Whitesbridge Ave.

P.O. Box 336

Kerman, CA 93630

Telephone: 559-846-6689

This space is for the County Clerk's Filing Stamp

**PROOF OF PUBLICATION**

(2015 S.C.C.P.)

STATE OF CALIFORNIA

County of Fresno,

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the **West Side Advance**, a newspaper of general circulation, printed and published weekly in the City of Kerman, County of Fresno, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Fresno, State of California, under the date of February 9, 1956, Case Number 45745; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following date, to-wit:

Dec. 31, Jan 7

all in the year 20 09. I Certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Kerman, California this 7th

day of January, 20 09

Kathy A. Matthe

Signature

Proof of Publication

Notice of Hearing on Intention  
To Update Groundwater

NOTICE OF HEARING ON INTENTION TO UPDATE GROUNDWATER MANAGEMENT PLAN FOR JAMES IRRIGATION DISTRICT NOTICE IS HEREBY GIVEN that at 10:00 a.m. on January 13, 2009, at 8749 9th Street, San Joaquin, CA, a public hearing will be held to discuss whether or not the James Irrigation District should update their Groundwater Management Plan to be in compliance with California

Senate Bill No. 1938.

Part 2.75 of Division 6 of the California Water Code permits the adoption and implementation of Groundwater Management Plans to encourage authorized local agencies to manage groundwater resources within their service areas.

Landowners within the agency boundaries and other interested parties are invited to attend the hearing. Opportunity for public questions and input will be provided at the hearing. In compliance with Water Code § 10753.4 (b), landowners and other interested parties who wish to participate in preparing the Groundwater Management Plan may do so by attending the hearing and indicating their interest or by submitting a written letter to John Malliyon, General Manager, James Irrigation District, 8749 9th Street, San Joaquin, CA 93660.

John Malliyon

District Manager

Dated December

22 2008

5311-w53-1c

# **RESOLUTION 2009-01**

## **RESOLUTION OF THE BOARD OF DIRECTORS JAMES IRRIGATION DISTRICT**

### **INTENTION TO UPDATE GROUNDWATER MANAGEMENT PLAN**

At a meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT, a public Irrigation District organized and existing under the Irrigation District Law (California Water Code, Division 11, Section 20,500 *et seq.*) of the State of California, held on the 13<sup>th</sup> day of January, 2009, the following resolution was adopted:

WHEREAS, the JAMES IRRIGATION DISTRICT adopted a Groundwater Management Plan in 2001 that is in accordance with Assembly Bill 3030; and

WHEREAS, the California Water Code permits the adoption and implementation of Groundwater Management Plans to encourage authorized local agencies to manage groundwater resources within their service areas; and

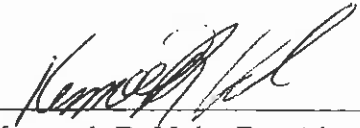
WHEREAS, updating the District's Groundwater Management Plan is in furtherance of and consistent with the District's goals and objectives and will be in the best interests of the District's landowners and water users; and

WHEREAS, a public hearing was held on January 13, 2009, to discuss updating the Groundwater Management Plan;


NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the JAMES IRRIGATION DISTRICT that it is the intention of the District to update their Groundwater Management Plan in accordance with Senate Bill No. 1938, that this resolution shall be deemed a resolution of intention in accordance with California Water Code Section 10753.2 and that the Board hereby authorizes its officers to execute all documents and take any other action necessary or advisable to carry out the purposes of this resolution.

The foregoing Resolution was introduced and adopted at a Regular Meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT conducted January 13<sup>th</sup>, 2009, on motion of Director Robert Motte, and seconded by Director Thomas Chaney, was hereby authorized by the following vote:

AYES:	5	(Motte, Chaney, Ayerza, Carvalho, Hale)
NOES:	0	
ABSTAIN:	0	
EXCUSED:	0	
ABSENT:	0	

  
\_\_\_\_\_  
Kenneth R. Hale, President  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

ATTEST:

  
\_\_\_\_\_  
Donna Y. Hanneman, Secretary  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

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CERTIFICATION OF SECRETARY

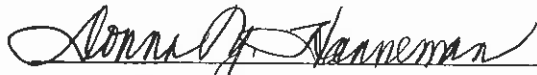
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The undersigned certifies that she is the Secretary of JAMES IRRIGATION DISTRICT and that the foregoing Resolution was adopted by the Board of Directors of said District at a meeting thereof, duly and regularly held on January 13<sup>th</sup>, 2009, at which meeting a quorum of the Board of Directors was at all times present and acting.

IN WITNESS WHEREOF, I have set my hand and seal of the Board of Directors this 13<sup>th</sup> day of January, 2009.

{ SEAL }



Donna Y. Hanneman, Secretary  
BOARD OF DIRECTORS  
JAMES IRRIGATION DISTRICT

**WEST SIDE ADVANCE**

14693 W. Whitesbridge Ave.

P.O. Box 336

Kerman, CA 93630

Telephone: 559-846-6689

This space is for the County Clerk's Filing Stamp

**PROOF OF PUBLICATION**  
(2015.5 C.C.P.)

STATE OF CALIFORNIA

County of Fresno,

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above entitled matter. I am the principal clerk of the printer of the **West Side Advance**, a newspaper of general circulation, printed and published weekly in the City of Kerman, County of Fresno, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Fresno, State of California, under the date of February 9, 1956, Case Number 45745; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following date, to-wit:

April 8, 15

all in the year 20 09. I Certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Kerman, California this 15<sup>th</sup>

day of April, 20 09

Ruth A. Matthe

Signature

Proof of Publication

Resolution 2009-01

Resolution of James Irrigation District

**RESOLUTION 2009-01**

**RESOLUTION OF THE BOARD OF DIRECTORS JAMES IRRIGATION DISTRICT**

**INTENTION TO UPDATE GROUNDWATER MANAGEMENT PLAN**

At a meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT, a public Irrigation District organized and existing under the Irrigation District Law (California Water Code, Division 11, Section 20,500 et seq.) of the State of California, held on the 13th day of January, 2009, the following resolution was adopted:

WHEREAS, the JAMES IRRIGATION DISTRICT adopted a Groundwater Management Plan in 2001 that is in accordance with Assembly bill 3030; and

WHEREAS, the California Water Code permits the adoption and implementation of Groundwater management Plans to encourage authorized local agencies to manage groundwater resources within their service areas; and

WHEREAS, updating the District's Groundwater Management Plan is in furtherance of an consistent with the District's goals and objectives and will be in the best interests of the District's landowners and water users; and

WHEREAS, a public hearing was held on January 13, 2009, to discuss updating the Groundwater management Plan

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the JAMES IRRIGATION DISTRICT that it is the intention of the District to update their Groundwater Management Plan in accordance with Senate Bill No 1938, that this resolution shall be deemed a resolution of intention in accordance with California Water Code

Section 10753.2 and that the Board hereby authorizes its officers to execute all documents and take any other action necessary or advisable to carry out the purposes of this resolution.

The foregoing Resolution was introduced and adopted at a Regular Meeting of the Board of Directors of the JAMES IRRIGATION DISTRICT conducted January 13th, 2009, on motion of Director Robert Motte, and seconded by Director Thomas Chaney, was hereby authorized by the following vote:

AYES: 5 (Motte, Chaney, Ayerza, Carvalho, Hale)

NOES: 0

ABSTAIN: 0

EXCUSED: 0

ABSENT: 0

Kenneth R. Hale, President

BOARD OF DIRECTORS JAMES IRRIGATION DISTRICT

ATTEST:

Donna Y. Hanneman, Secretary

BOARD OF DIRECTORS JAMES IRRIGATION DISTRICT

CERTIFICATION OF SECRETARY

The undersigned certifies that she is the Secretary of JAMES IRRIGATION DISTRICT and that the foregoing Resolution was adopted by the Board of Directors of said District at a meeting thereof, duly and regularly held on January 13th, 2009, at which meeting a quorum of the Board of Directors was at all times present and action

IN WITNESS WHEREOF, I have set my hand and seal of the Board of Directors this 13th day of January, 2009.

Donna Y. Hanneman, Secretary

BOARD OF DIRECTORS JAMES IRRIGATION DISTRICT

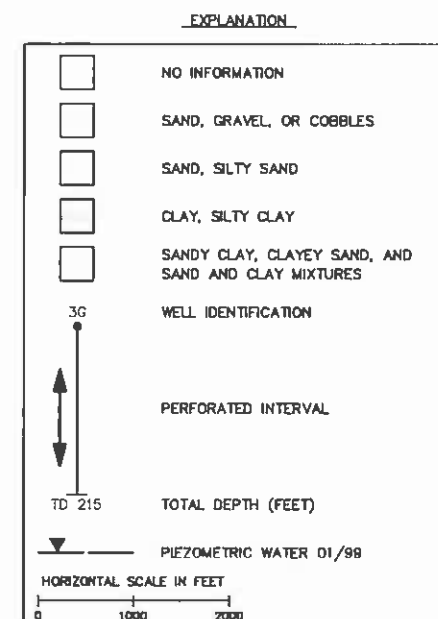
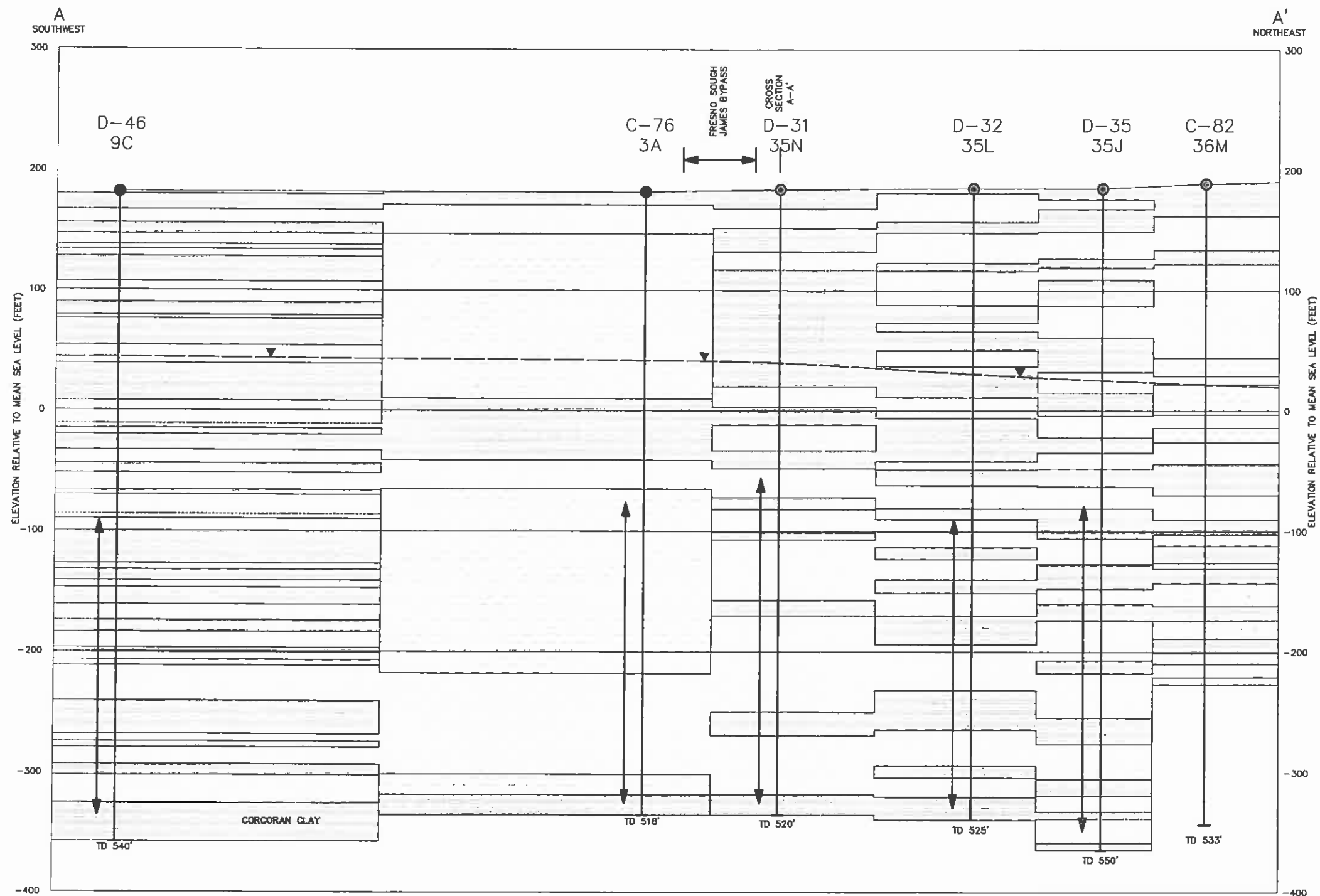
1405-W14-15C

JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***APPENDIX B***  
***GEOLOGIC CROSS SECTIONS***





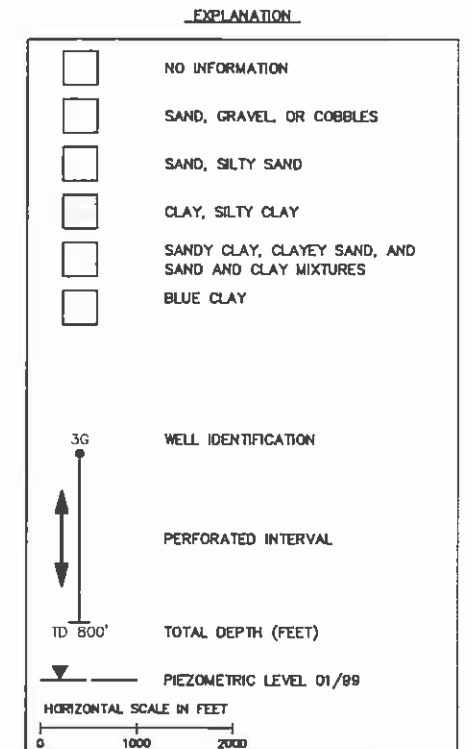
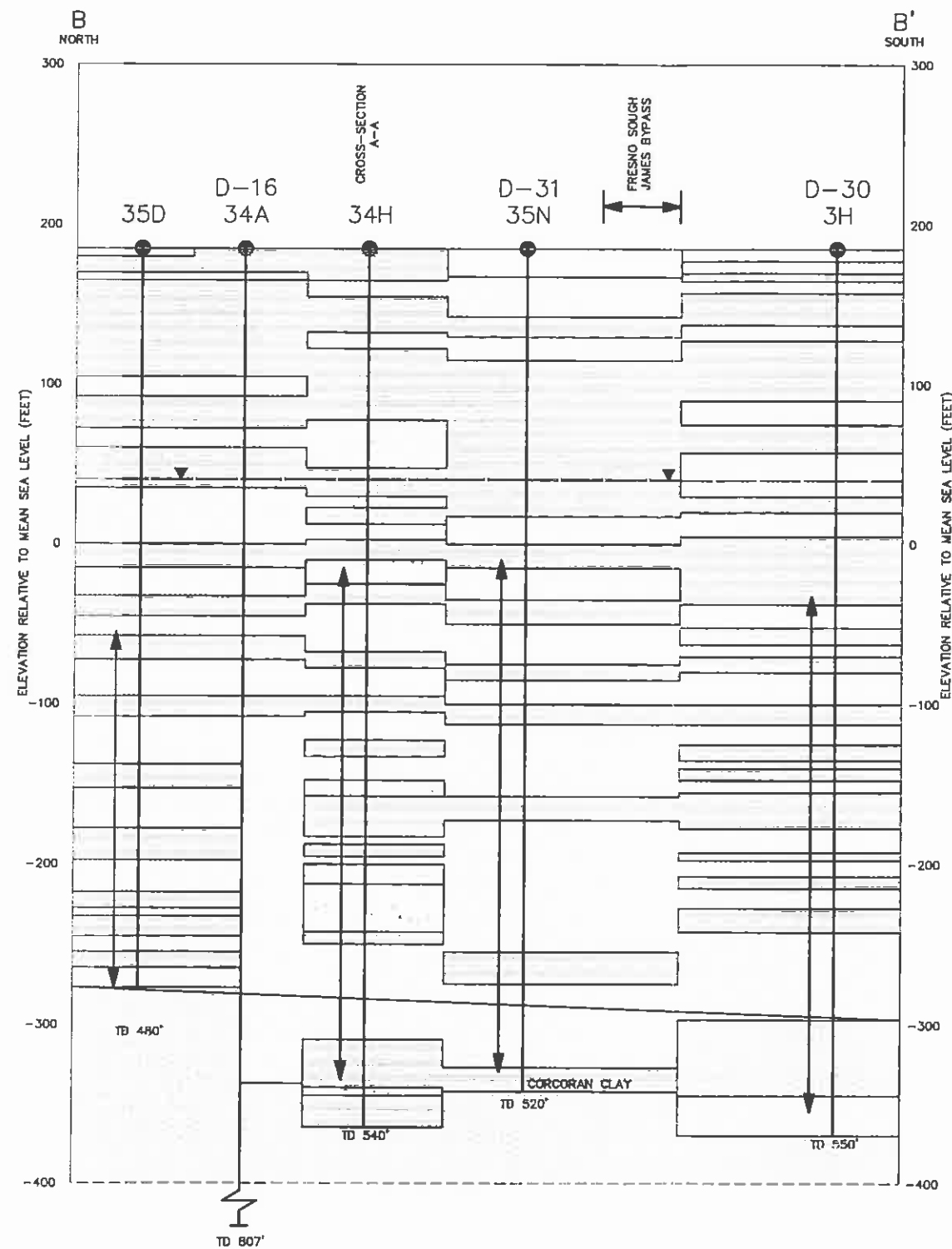
Kenneth D. Schmidt  
 C.E. License No. 44333

**PROVOST & PRITCHARD**  
 ENGINEERING GROUP  
 208 WEST ORANGE AVENUE  
 FRESNO, CALIFORNIA 93704-1402  
 553/448-2700 FAX 553/448-2715  
 www.provostpritchard.com

Job No. 105108C1  
 Dwg. No.

James Irrigation District Fresno County, CA		SCALE AS SHOWN
Subsurface Geologic Cross Section A-A'		DRAWN BY ARM
DESIGN ENGINEER		REVISED
DATE 2-13-01 C.E. LICENSE NO.		SHEET
Date Revised		1 OF
Approval		1 SHEETS

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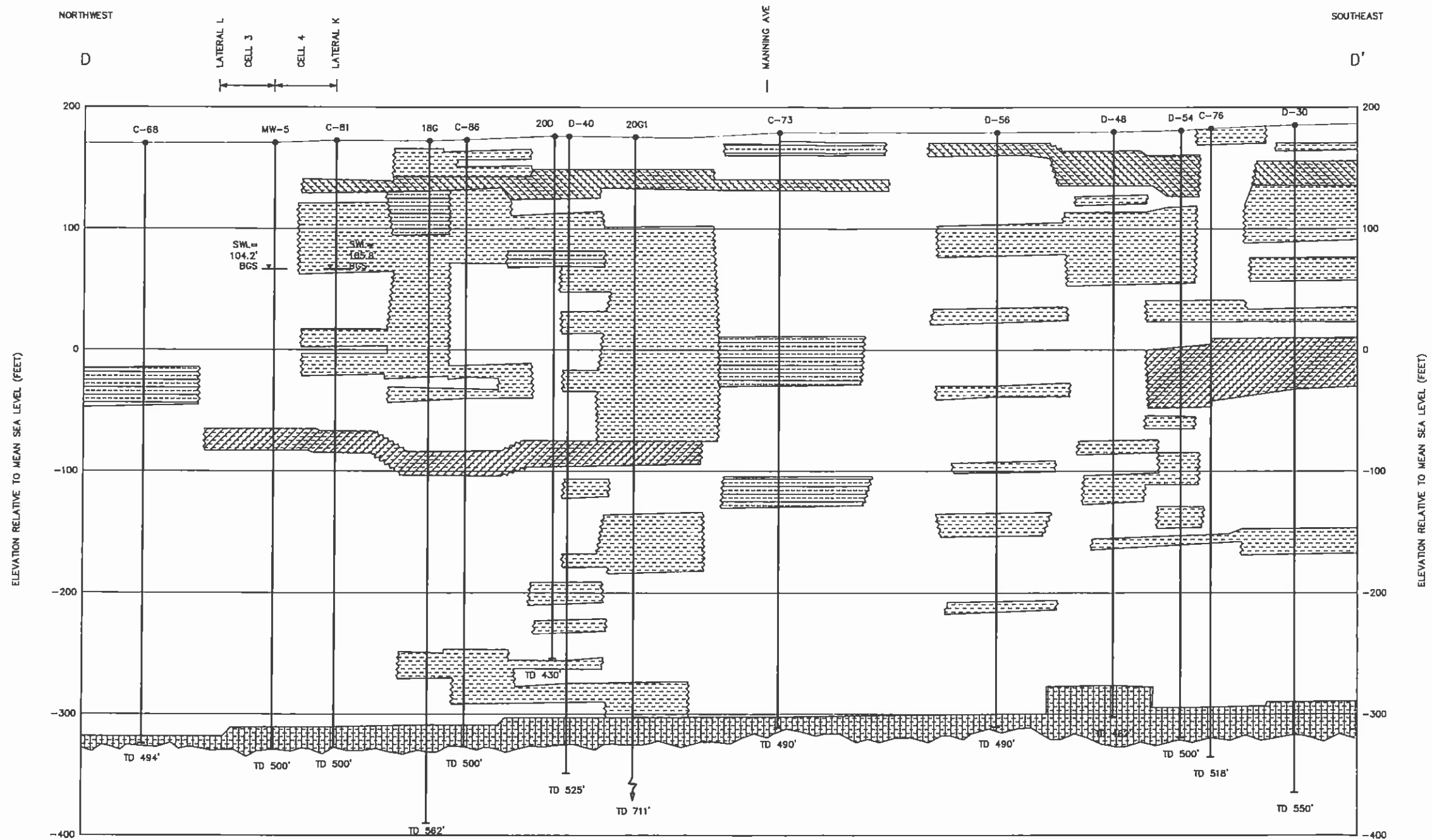
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**Fresno County, CA**  
**Subsurface Geologic**  
**Cross Section B-B'**

DESIGN ENGINEER	DATE 2-13-01	C.E. LICENSE NO.	
Job No. 10510BC1	Date Revised		
Dwg. No.	Approval		

SCALE	AS SHOWN
DRAWN BY	AWC
REVISED	
SHEET	1 OF 1
1 SHEETS	

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**EXPLANATION**

CLAY

A-CLAY

C-CLAY

CORCORAN CLAY

SANDY CLAY

OTHER DEPOSITS

C-68 WELL IDENTIFICATION

TD 494' TOTAL DEPTH (FEET)

0 2000 4000

HORIZONTAL SCALE IN FEET

Kenneth D. Schmidt  
OF PROVOST & PRITCHARD

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**James Irrigation District**  
Fresno County, CA

**Subsurface Geologic**  
**Cross Section D-D'**

DESIGN ENGINEER	DATE 3/8/2005	C.E. LICENSE NO.	SHEET 1 OF 1
Date Revised	Approval		1 SHEETS

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JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

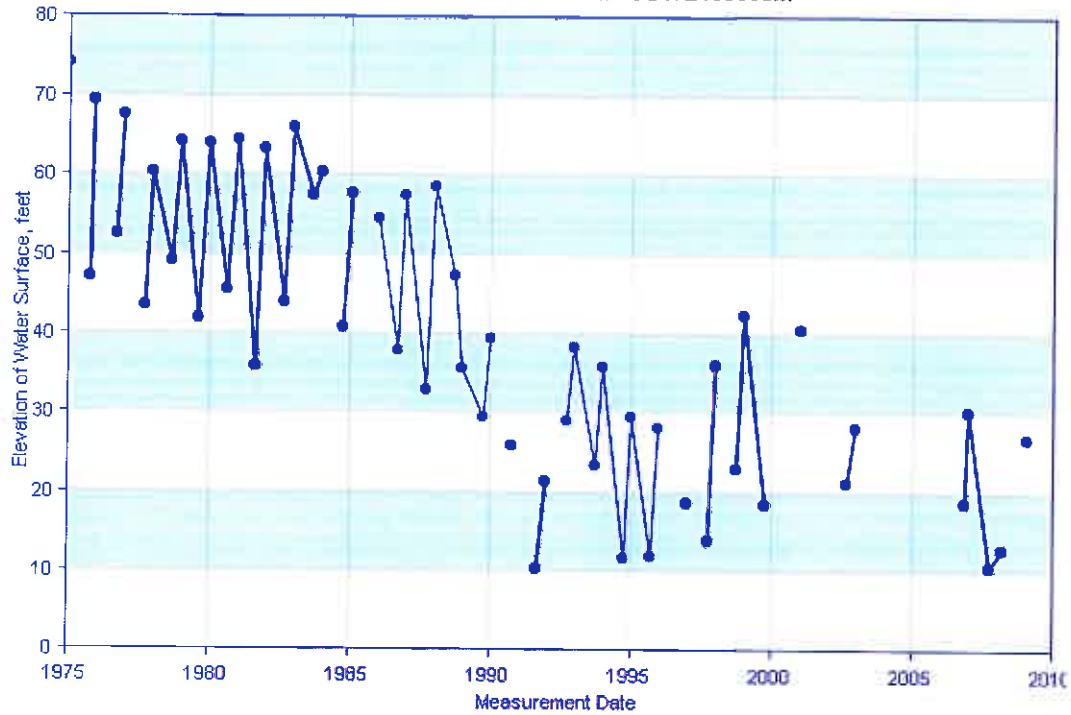
GROUNDWATER MANAGEMENT PLAN

***APPENDIX C***  
***WELL HYDROGRAPHS***

**JAMES IRRIGATION DISTRICT**  
**APPENDIX C - INDICATOR WELL HYDROGRAPHS**

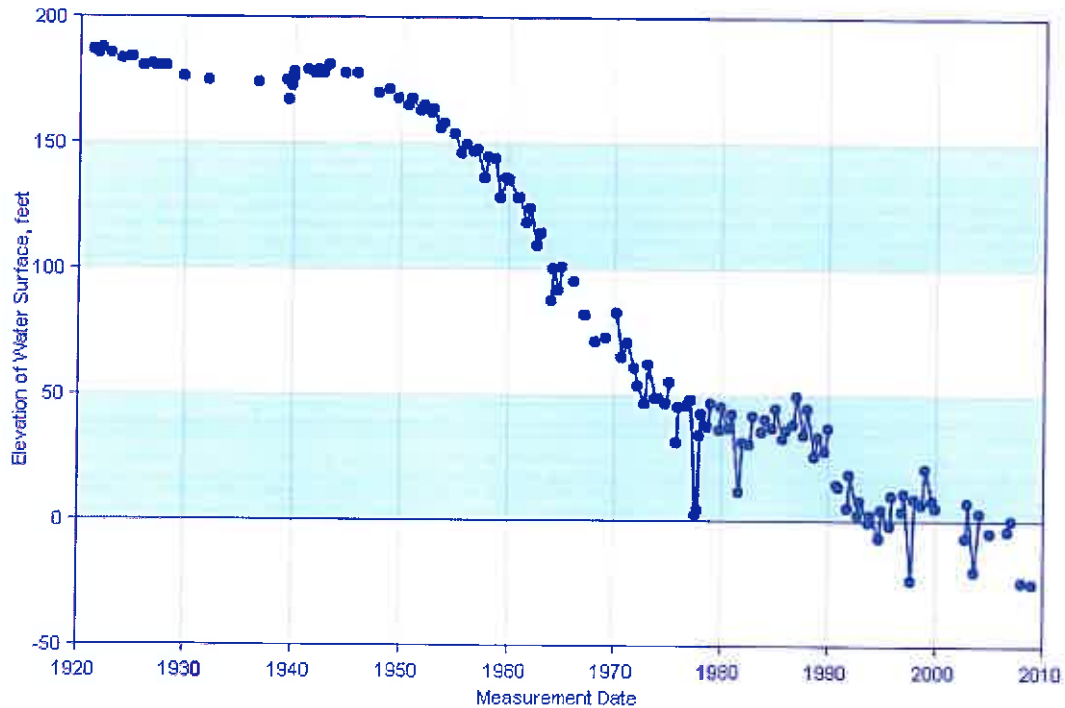
**Kerman Line of Eastside Wellfield**

Groundwater Levels in Well 15S17E15J003M



**Along McMullin Grade in Eastside Wellfield**

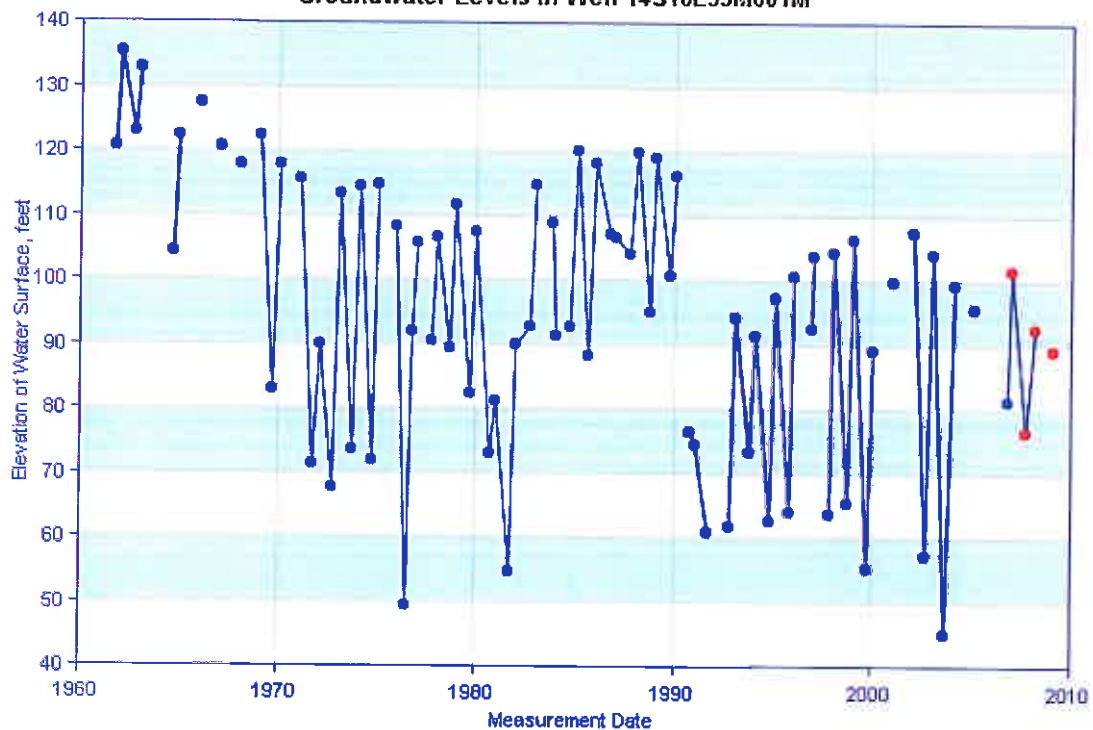
Groundwater Levels in Well 15S18E30L001M



**JAMES IRRIGATION DISTRICT**  
**APPENDIX C - INDICATOR WELL HYDROGRAPHS**

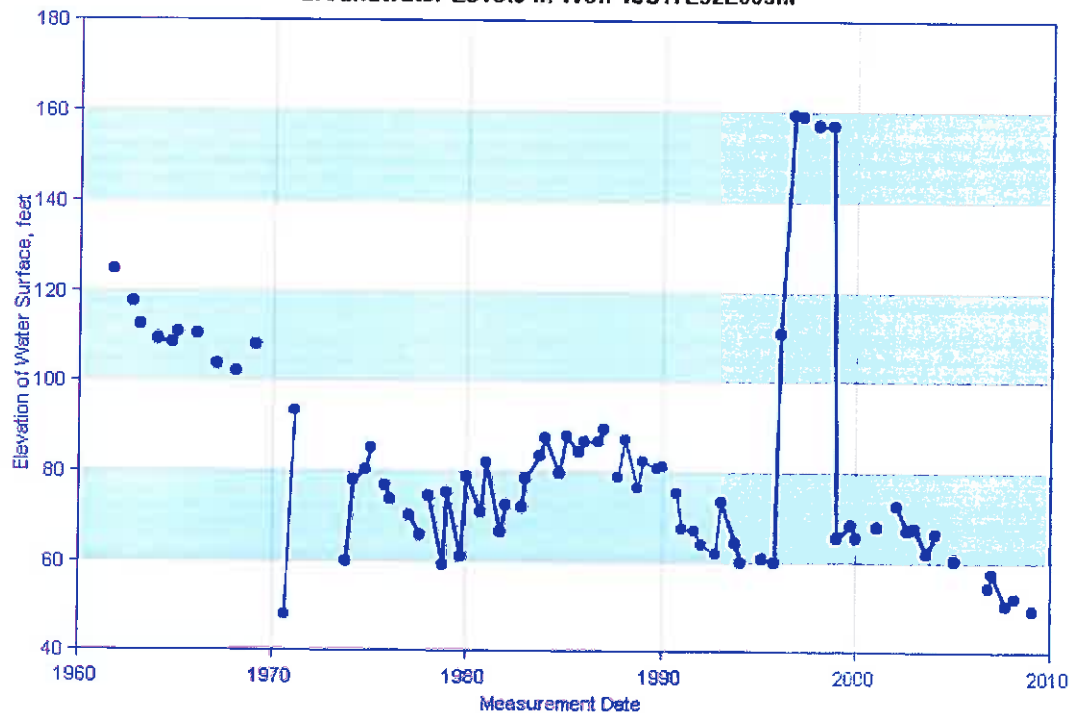
**Northern Part of James Irrigation District**

Groundwater Levels in Well 14S16E35M001M



**Southeast of the City of San Joaquin**

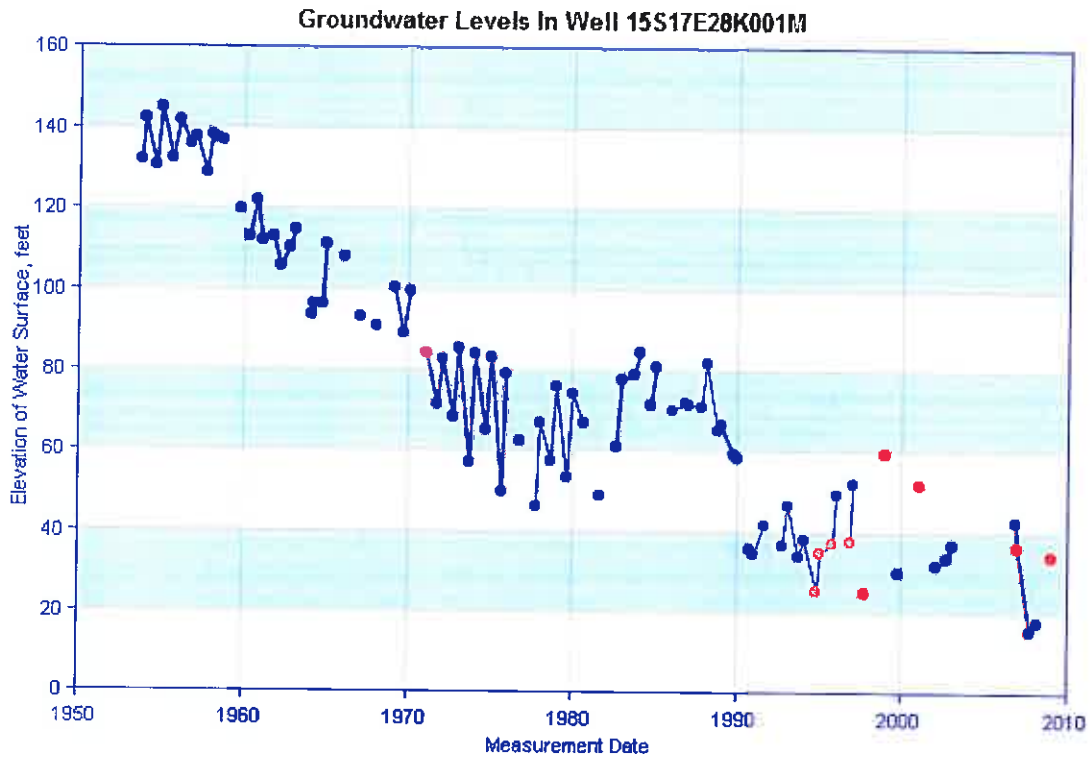
Groundwater Levels in Well 15S17E32L003M



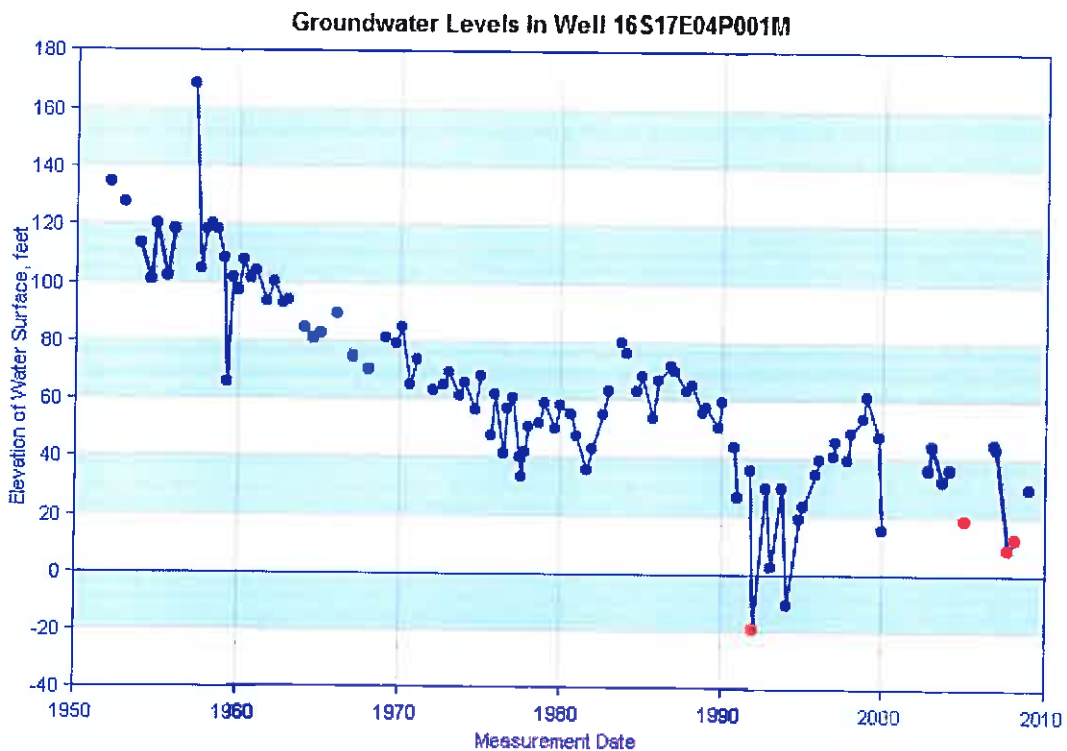


# JAMES IRRIGATION DISTRICT APPENDIX C - INDICATOR WELL HYDROGRAPHS

## Along James Irrigation District Main Canal



## Southern Boundary of James Irrigation District



JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***APPENDIX D***  
***GROUNDWATER QUALITY DATA***



## WELL WATER QUALITY TESTS

LOCATION	STATUS	YEAR >> WELL #		August 2009 PPM	2009 PPM	2008 PPM	2007 PPM	2006 PPM	2005 PPM	2004 PPM	2003 PPM	2002 PPM	2001 PPM	2000 PPM	1999 PPM	1998 PPM	1997 PPM	1996 PPM	1995 PPM	1994 PPM	1993 PPM	1992 PPM	1991 PPM	1990 PPM	1989 PPM	1988 PPM	1987 PPM	1986 PPM	1985 PPM	1984 PPM	1983 PPM	1982 PPM	1981 PPM	1980 PPM	1979 PPM	1978 PPM	1977 PPM	AVG
COALINGA	ABANDONED	C-49	C-49																						1,025	1,000	800		775	700		700	625	650				784
COALINGA	ABANDONED	C-53	C-53														350	350							350	325	300	250		200	400	300	250	250				310
COALINGA	ABANDONED	C-54	C-54																						300		250	200		175	300	200	200	225				233
MAIN CANAL		C-55	C-55		1,200	1,275	1,200		1,325	1,200	1,100	1,300	1,200	1,300	1,300		1,300	1,275				1,100	1,200	1,150	1,225	1,250	1,250	1,000	1,100	1,050	1,100	1,125	1,150			1,250	1,197	
MAIN CANAL		C-56	C-56		1,100	1,100	1,075		1,150	1,100	1,000	1,150	1,100	1,150	1,200		1,200	1,125				1,000	1,100	1,100	1,075	1,050	1,075		950	900	1,000	975	1,000			1,050	1,072	
COALINGA	ABANDONED	C-57	C-57									1,275	1,300	1,400	1,500		1,000	550							425	500			300	300	225	250	225					693
KERMAN		C-58	C-58	820	650	650	575	900	800	575	550	575	625	625	650		900	850				250	575		525	550	775		800	800	800	500	900					870
KERMAN	ABANDONED	C-59	C-59				1,600	1,450	1,675	1,400	1,400	1,600	1,700	1,700	1,800		1,750	1,750				700	1,250	1,300	1,200	1,250	1,000		980	1,100	1,100	9,000	1,000				1,714	
KERMAN		C-60	C-60	975	825	900	850	900	850	900	750	700	825	850	850		850	850				650	750		700	675	750		575	600	600	550	600				748	
COALINGA		C-61	C-61		725	800	800	850	800	675	800	800	825	850	850		750	750				600	550		750	725	600	500	400	300	350	275	275				850	
KERMAN		C-62	C-62	1,850	1,750	1,825	1,875	2,000	2,000	1,750	1,500	1,700	1,800	2,050	1,950		2,000	2,150				1,500	1,450		1,725	1,500	1,650		1,300	1,300	1,325	1,300	1,550				1,893	
MAIN CANAL	ABANDONED	C-63	C-63															350				350	350		325	300	300	250	225	225	250		250	260	300	275		286
MAIN CANAL	ABANDONED	C-64	C-64																																			
MAIN CANAL		C-65	C-65		950	1,000	950		1,050	1,000	950		900	1,000	1,050	1,075		1,050	1,075				1,000	1,025		1,175	1,200	1,250										



WELL WATER QUALITY TESTS  
TOTAL DISSOLVED SOLIDS / PARTS PER MILLION

LOCATION	STATUS	YEAR >> WELL #		August 2009 PPM	2009 PPM	2008 PPM	2007 PPM	2006 PPM	2005 PPM	2004 PPM	2003 PPM	2002 PPM	2001 PPM	2000 PPM	1999 PPM	1998 PPM	1997 PPM	1996 PPM	1995 PPM	1994 PPM	1993 PPM	1992 PPM	1991 PPM	1990 PPM	1989 PPM	1988 PPM	1987 PPM	1986 PPM	1985 PPM	1984 PPM	1983 PPM	1982 PPM	1981 PPM	1980 PPM	1979 PPM	1978 PPM	1977 PPM	AVG
MAIN CANAL		D-54	D-54		375	350	225	325	425	350	300	325	325	325	350		400																					340
MAIN CANAL		D-55	D-55		400	400	275	325	375	350	300	350	350	350	375		400																					354
INSIDE		D-56	D-56		725	800	675	725	900	700	800	700	650																									742
KERMAN		D-57	D-57	577	525	575	450	500	650																													540
MAIN CANAL		D-58	D-58		375	400	300	350	375																													360
KBSN RECOVERY		D-59			350																																	350
KBSN RECOVERY		D-60			800	850																																825
COALINGA		D-62		562	575																																	575
COALINGA		D-63			525																																	525
		16-16-3E1		8,490																																		
AVERAGE					739.407	807.456	731.466	690.476	633.28	735.776	691.364	770.089	772.8	784.1	793.8		817.2	824.6			710.6	713	1214	686.8	697.2	702.9	519.4	267.5	541.1	569.5		550.9	689.7	689.8			728.9	
TOTAL WELLS TESTED					59	67	58	42	68	58	55	56	58	58	56	0	58	58	0	0	33	54	7	53	44	51	36	8	50	60	0	51	50	49	0	0	19	
LEGEND:																																						
* ABANDONED					28	1	1	6	0	2	0	1	2	1	1	2	1	0	0	0	2	0	1	1	0	0	0	3	2	0	0	1	1	0	0	0	0	18

JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***APPENDIX E***

***MOU BETWEEN JAMES IRRIGATION DISTRICT AND  
CITY OF SAN JOAQUIN***

**MEMORANDUM OF UNDERSTANDING  
BETWEEN  
JAMES IRRIGATION DISTRICT  
AND  
THE CITY OF SAN JOAQUIN**

This Memorandum of Understanding (MOU) between the JAMES IRRIGATION DISTRICT, a California Irrigation District ("District") and the City of San Joaquin ("City") is intended to introduce a cooperative set of guidelines for the District and City to improve coordination of water management activities in the local area.

**PURPOSE**

The main objectives of this MOU is to introduce a set of guiding principles by which the District and City can more effectively manage water resources in the local area. This will be accomplished through the following general tasks:

- Identify common interests and goals
- Discuss and coordinate multi-agency projects of mutual benefit
- Work to understand the perspectives of the other parties
- Provide a more comprehensive view and approach towards water management in the area
- Improve overall water reliability and water quality in the area
- Attempt to reach consensus on water management issues wherever possible

**GROUNDWATER MANAGEMENT PLAN**

The District created a Groundwater Management Plan (GMP) in 1992. The District is currently updating the GMP to be compliant with California Senate Bill No. 1938 and California Water Code Section 10750 et. seq. The City and the District believe it is in their mutual interests to prepare a joint GMP covering both agencies. The GMP shall include specific provisions regarding the City's inclusion and role in the Groundwater Advisory Committee. In that regard Section 4 of the current Draft GMP shall be amended to reflect the City's position and role in the Groundwater Advisory Committee. After the GMP is completed, the District and City will work cooperatively to implement the goals and objectives outlined in the GMP.

**WATER MANAGEMENT EFFORTS**

The two agencies shall agree to cooperate on the following water management efforts to the benefit of both agencies:

1. The agencies shall share groundwater level and groundwater quality data. Copies of the data will be brought to an annual coordination meeting.
2. The agencies shall work to better understand the regional groundwater quality and



its potential for impacting local groundwater supplies.

3. The agencies shall cooperate to protect the groundwater quality for domestic, industrial and agricultural use.
4. The agencies shall work to find beneficial use for wastewater generated in San Joaquin, preferably within the boundaries of the James Irrigation District
5. The agencies shall work cooperatively to implement both urban and agricultural water conservation measures.
6. The agencies shall work to develop groundwater recharge basins in James Irrigation District and the City of San Joaquin using surplus water, floodwaters and stormwater runoff.
7. The agencies shall collaborate on water resources studies and planning documents and search for water resources projects that mutually benefit both agencies
8. The agencies shall work to develop consistent land use planning ordinances that are favorable to groundwater usage, groundwater quality protection, groundwater recharge, and surface water usage and quality and shall comment on land use plans and environmental documents that impact groundwater resources.
9. The agencies shall work to prevent groundwater adjudication by establishing local control of groundwater and work towards matching groundwater pumping, over the long term, with the groundwater safe yield.

#### **FUNDING**

The District and City have a joint interest in improving the water resources in the local area, and therefore shall work cooperatively to secure grants and low interest loans to fund water resources projects for both agencies. This shall be accomplished by notifying the other agency of funding opportunities, writing letters of support for applications, and, when feasible, teaming on funding applications for projects that will benefit both agencies.

#### **ANNUAL COORDINATION MEETING**

The City and District will meet annually and as needed to coordinate efforts and discuss relevant water management issues. The meeting shall be held in November of each year beginning in 2010. The District shall contact the City each year in October to discuss the agenda arrangements for the next meeting.

#### **AREA OF PLAN**

This MOU shall be effective in all areas within the City of San Joaquin, James Irrigation District, and District eastside well field. The MOU shall also be effective in any areas newly annexed by the agencies.

#### **OBLIGATIONS**

The participants in this MOU understand that final decisions in regard to any agreement or decision made as a result of this MOU, or efforts arising from coordination efforts, will be subject to approval by the James Irrigation District Board of Directors and San Joaquin City Council. The District and City expressly state herein that this MOU does not

constitute a joint powers agreement.

**TERM**

The initial term of the MOU shall commence on the date signed by both agencies, and continue for five (5) years, and shall continue year to year thereafter. This MOU can be terminated by either agency at any time including the initial term for any reason with 30 days written notice to the other party.

The City and District hereby acknowledge the potential benefits of pursuing the aforementioned water management actions and agree to work together to implement such actions. In WITNESS WHEREOF, the parties have executed this MOU as of the effective date.

JAMES IRRIGATION DISTRICT

CITY OF SAN JOAQUIN

By: 

By: 

Title: GENERAL MANAGER

Title: CITY MANAGER

Date: APRIL 13, 2010

Date: 4-21-2010

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***APPENDIX F***  
***GROUNDWATER QUALITY MONITORING AND  
MITIGATION PLAN***

# JAMES IRRIGATION DISTRICT



## GROUNDWATER QUALITY MONITORING AND MITIGATION PLAN

JULY 2010

PREPARED BY:





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**Attachment 1 – Groundwater Quality Map**

**Attachment 2 – Groundwater Quality Graphs by Region**



**List of Abbreviations**

AF	Acre-feet
DWR	Department of Water Resources
gpm	gallons per minute
JID	James Irrigation District
MP	Monitoring Plan
PVC	Poly-vinyl chloride
TDS	total dissolved solids





## **1 - INTRODUCTION**

### **1.1 - Overview**

This monitoring plan (MP) provides guidelines for monitoring the groundwater supply in the James Irrigation District.

This monitoring plan addresses the following topics:

- Monitoring well network
- Groundwater levels
- Groundwater quality
- Mitigation recommendations
- Annual monitoring reports

The following sections provide details of the monitoring plan including monitoring locations, monitoring frequency, water quality constituents, etc.

### **1.2 - Purpose of Monitoring Plan**

The objectives of the monitoring plan are to provide the District with documented information to accomplish the following:

1. Evaluate short-term and long-term changes in groundwater levels to determine the extent of groundwater overdraft, or impact from groundwater recharge facilities.
2. Monitor western JID for shallow groundwater and characteristics typical of drainage impacted lands.
3. Evaluate groundwater quality in western JID for encroachment of poor water quality waters from the west.
4. Evaluate groundwater quality in the Eastside Wellfield for encroachment of saline waters from the Raisin City Oilfield.
5. Identify and monitor measures to mitigate the groundwater quality.

### **1.3 - Existing Groundwater Quality**

The groundwater quality in JID was evaluated through an analysis of long-term trends and spatial characteristics in total dissolved solids. Total dissolved solids (TDS) is often used as a general indicator of groundwater quality, and it is the only parameter that was consistently monitored in JID for the past 30 years. The analysis did not include a statistical evaluation because most wells lack a sufficient number of data points for a meaningful analysis. Rather, the evaluation is based on visual examination of TDS graphs. The TDS data and graphs used in the analysis can be found in **Appendix A**. The District was separated into six different areas based on 'Area B', thought to be impacted by the Raisin City Oilfield, and 'Area A', an area with little groundwater quality data that is experiencing growth in irrigation well development. These areas are shown

**James Irrigation District**  
**Groundwater Quality Monitoring and Mitigation Plan**



on the attached Groundwater Quality Map (**Attachment 1**). There is insufficient long-term data in Area C to form any conclusions. Note that not all District wells were used in the analysis, but instead representative wells with long-term data in each area were used. The results are summarized in **Table 1** below.

**Table 1 – Groundwater Quality Evaluation for James Irrigation District (TDS)**

Area	Average*	Range*	Long-Term trend		GW Quality vs. Perforated Interval
			ppm/year*	Remarks	
A	700	300-1,000	+10	Mixed	All perforations similar (~260 to 500 feet)
Vicinity of Area A	375	325-500	Stable	Stable except for slight increase in last 2 years	All perforations similar (~250 to 500 feet)
Area B	1,200	500-2,500	+30	Wells used to have similar water quality but now there is a wide range. All wells increasing in TDS. Well C-70 went up 2,000 ppm in 17 years.	Improves with depth. Wells perforated from 360 to 780 feet have best water quality.
North of Area B	1,100	500-1,750	+2	Mixed but overall slight increase.	Most wells perforated in the same interval but there appears to be a slight improvement with depth
West of Area B	650	375-1250	+10	Most wells increasing each year	Wells perforated in approximately the same depths
East of Area B	400	200-750	+ 7	Wells used to have similar water quality but now there is a wide range. Big jump in 2007 to 2008. Worst near Well C-62 with water quality improving north and south.	No pattern of water quality with depth.

# **James Irrigation District**

## **Groundwater Quality Monitoring and Mitigation Plan**

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\* The average, range and long term trend (ppm/year) were based on a visual examination of graphs and are considered approximate.



## **2 - MONITORING WELL NETWORK**

The monitoring network will include a combination of JID recovery wells (operational and abandoned), JID monitoring wells, and some private wells (operational and abandoned).

Due to a constantly evolving well network a thorough well canvass is recommended to inventory all existing wells. A well canvass would provide helpful information for planning new well sites and evaluating impacts to wells from existing and new JID wells. The well canvass would document the following information for each well:

- Well location (address and section, township and range)
- Well ID number
- Well owner
- Type of well
- Well status (active, abandoned, etc.)
- Well casing diameter
- Well depth
- Perforated interval
- Foundation
- Power supply
- Horsepower
- Discharge pipe diameter
- Discharge direction
- PG&E Tag No.
- Ground surface elevation
- Reference point elevation
- Digital image of well site



### 3 - GROUNDWATER LEVEL MONITORING

#### **Existing Groundwater Level Monitoring**

Groundwater level monitoring in JID includes the following:

**Bi-annual Monitoring.** PG&E pump tests are performed at each production well every other year, and water levels are measured as part of the tests.

**Semi-annual Monitoring.** Seventeen production and monitoring wells scattered throughout the District are monitored semi-annually (January and October) and the data is reported to DWR.

**Monthly Monitoring.** Five monitoring wells scattered throughout the District are monitored monthly.

**Weekly Monitoring.** Several monitoring and recovery wells at the Lateral K Recharge Basin are monitored weekly. In addition, several wells have data loggers for collecting continuous data.

A thorough well canvass (see Section 2) is recommended to list and inventory all the wells that are monitored.

#### **Monitoring Recommendations for New Wells**

The following recommendations are provided for monitoring new wells:

**New production wells.** Any new production well should be monitored semiannually.

**New shallow monitoring wells in Westside of JID.** New shallow wells on the Westside of JID should be monitored monthly.

**New deep monitoring wells in Central Portion of JID.** New deep monitoring wells should be monitored at least semiannually.



#### **4 - GROUNDWATER QUALITY MONITORING**

The purpose of groundwater quality monitoring is to identify impacts to the local groundwater supply, and characterize the quality of the water that is pumped and delivered to local growers.

The following recommendations are provided for monitoring groundwater quality in JID

1. Continue to test each new well for an Agricultural Suitability Analysis.
2. Perform Agricultural Suitability Analysis every 5 years (2015, 2020, 2025, etc.) in selected wells in areas of concern. This will be timed with the submission of 5-Year Water Management Plans to the USBR.
3. Test for Additional Constituents in Wells near the City of San Joaquin. If funding from the City of San Joaquin is available, perform more detailed water quality sampling in JID wells near the City of San Joaquin. This information could be useful in determining the quality of groundwater than may be migrating toward the City. Constituents that could be tested include arsenic, gross alpha, Total Organic Carbon, and other constituents important to drinking water quality.
4. Continue to measure Total Dissolved Solids in each well annually. Perform the testing during the same month each year, and document the month in the summary spreadsheet.
5. Regularly calibrate the hand-held TDS meter used to test wells each year, to help ensure that measurements are accurate and trends are properly identified.

##### Testing Laboratory

Water quality testing should preferably be performed by the same laboratory each sampling period for consistency. Samples will be collected by JID staff or their engineering consultant. In the past, JID has typically used Fruit Grower's Laboratory of Visalia, California.

##### Modifications to Water Quality Monitoring

Overtime, there may be a need to add or remove sampling sites and to adjust the timing of the sampling events. This monitoring plan will be updated with changes to the locations and schedule as needed. If more sampling sites are needed then monitoring wells can be purged and samples collected, or the District could seek permission to collect water quality samples from private agricultural or domestic wells in the area.



## **5 - MITIGATION RECOMMENDATIONS**

The following measures are recommended to mitigate groundwater quality problems in the James Irrigation District.

### **WELL DRILLING**

**Continue Drilling Test Holes.** Currently, before production wells are drilled, a test hole is installed to determine the lithology and perform an E-log. The E-log is used as a relative measure of groundwater salinity. These test holes have shown that groundwater quality is usually, but not always, better beneath the Corcoran Clay. Continued use of test holes will help to identify the best depth for groundwater quality in new JID wells.

**Drill New Wells in Areas with Low TDS.** New wells can be drilled in areas that have historically had low TDS values and/or are not showing a temporal increase in TDS. *Currently, the best location for groundwater quality is the northeast portion of the JID wellfield easement.*

**Install Wells in Undeveloped Portion of JID Wellfield.** A portion of the JID eastside wellfield remains undeveloped with no canals or wells, in particular the area east of Dickenson Avenue on alignments along Bishop Avenue and Adams Avenue. No information is readily available on the groundwater quality in this area, but just to the west the wells produce the best groundwater quality of any JID wells.

**Install New Wells in Groundwater Recharge Areas.** New production wells can be installed in or near groundwater recharge areas so they can extract some of the lower TDS surface water that was recharged.

### **GROUNDWATER RECHARGE**

**Increase Groundwater Recharge.** An increase in groundwater recharge, either through construction of new facilities or diversion of more surface water, will help to improve the groundwater quality by diluting the lower TDS surface water with the higher TDS groundwater. Hence, groundwater recharge can be an effective form of salt management.

**Install Injection Wells for Groundwater Recharge.** Install injection wells (also known as aquifer-storage-recovery wells) in areas that do not have suitable soils for surface infiltration. This will also help to improve groundwater quality.

**Groundwater Recharge along McMullin Grade.** JID has numerous wells along McMullin Grade, but no dedicated recharge basins are operated in the area. JID's





groundwater recharge facilities are all located along the Fresno Slough Bypass. The McMullin Recharge Group has investigated potential recharge sites in the area, but no good sites were identified. Due to the potential benefits to the groundwater quality, JID should continue to investigate potential recharge sites along McMullin Grade.

## **WATER MANAGEMENT AND USAGE**

**Blend Water Supplies to Improve Water Quality.** Blend surface water and groundwater supplies so the water delivered to farms is not too high in salts or other constituents. This could be maximized by extending surface water deliveries as long as possible during the irrigation season (i.e. avoid groundwater only periods). This goal can be met with development of additional surface and subsurface storage, and delaying use of surface water when practical.

**Pump Lower TDS Wells when Feasible.** When feasible, particularly when only some of the District wells are being used, pump water from wells with the best water quality.

**Purchase Surface Water Supplies.** JID can purchase surplus or unused water supplies from other water agencies, such as the Fresno Irrigation District, and use the water in-lieu of groundwater pumping. The surface water would have better water quality than the groundwater, and any water that percolates will help to improve the groundwater quality.

## **OTHER**

**Reduce Seepage in Westside of District.** Minimize seepage from conveyance facilities to prevent buildup of shallow groundwater on the Westside of the District. This can be accomplished by compacting canal banks, lining canals, or pipelining canals. The amount of seepage on the District's west side is not accurately known. Therefore, a study and field tests may be needed to evaluate the merits and economics of any seepage control measures. Shallow monitoring wells constructed in 2010 showed groundwater levels were about 80 feet below ground surface, indicating there were no drainage problems. These wells should continue to be monitored.

**Prepare a Salt Management Plan.** Salt levels in JID area steadily rising, as evidenced from 30 years of continuous groundwater quality data. Under current practices, salts will continue to accumulate in the groundwater and soil, and reduce the beneficial use of the groundwater for crop irrigation. JID should prepare a Salt Management Plan as the initial step in identifying the salt loading sources as well as remedial and preventative measures. The State Water Resources Control Board is encouraging every region in California to develop salt/nutrient management plans by 2014, and it is possible that Salt Management Plans or salt monitoring will be required in the future.



**Reformed Land Practices.** Groundwater quality generally declines with an increase in pumping. Therefore, water conservation efforts can help to preserve the groundwater quality. Water usage can be reduced by shifting to less thirsty crops, and improving irrigation efficiencies with the installation of drip and micro-irrigation systems. JID will encourage growers to take these steps and will facilitate efforts to secure grants and low interest loans on behalf of the growers.



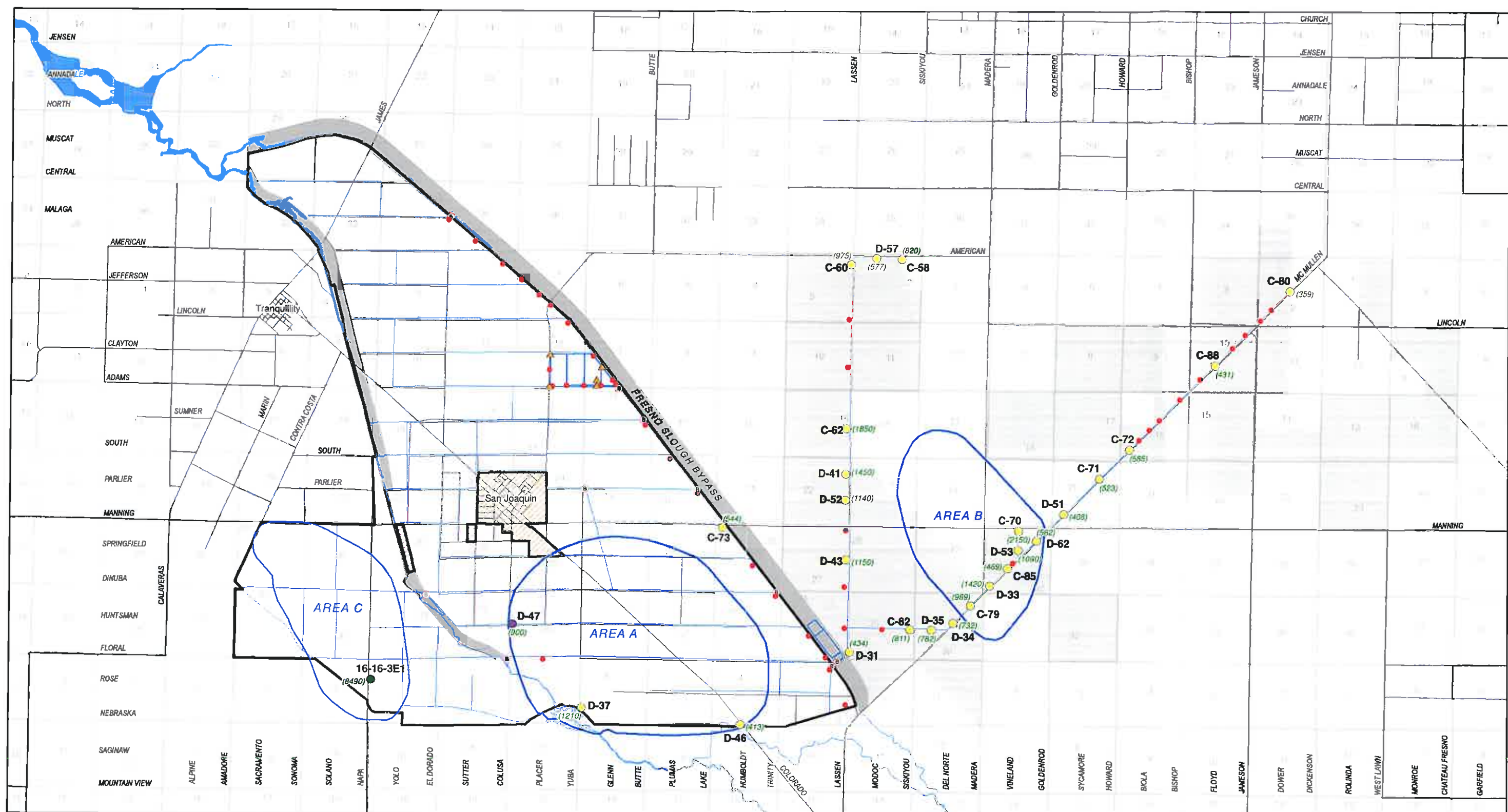
**REFERENCES**

Water Resources, *San Joaquin Valley Drainage District Report*, September 2003.

Oil Field Waste Water Disposal, *Raisin City Oil* 1955.

Engineering Group, Inc., *James Irrigation District 5-Year 2003-2004*, December 2005.

Engineering Group, Inc., *Groundwater Management for Local Groundwater Assistance Grant*, December



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**Legend**

- James ID
- Reclamation District 1606
- James ID Well Field
- Section

**Boosters, Lifts, and Wells**

- ▲ BOOSTER
- ▲ MONITOR WELL
- PRODUCTION WELL

**Wells Samples In August 2009**

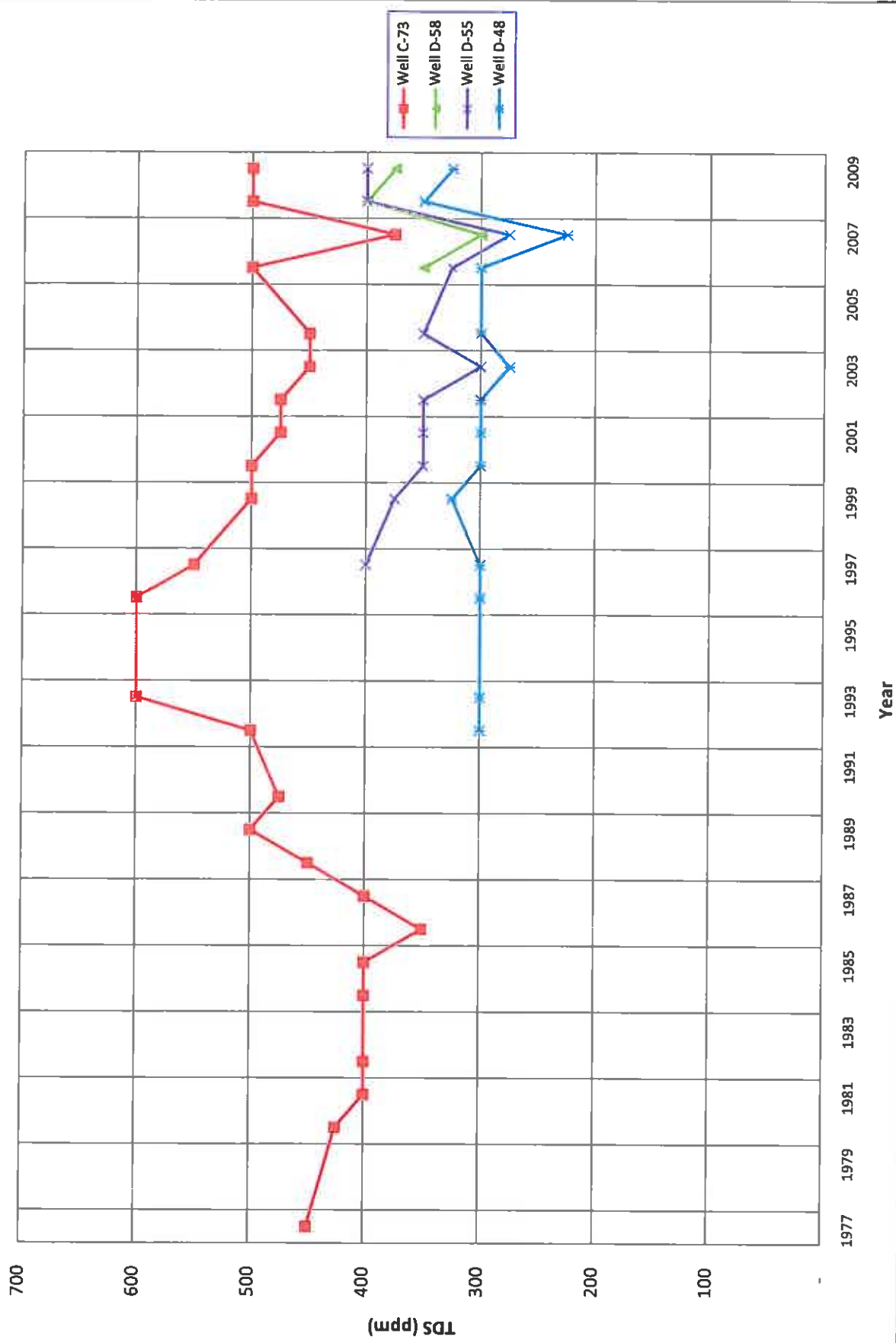
Labeled With Total Dissolved Solids (ppm)

- Irrigation Suitability Analysis
- Selenium and Irrigation Suitability Analysis
- Selenium, Arsenic, TOC, Gross Alpha and Irrigation Suitability Analysis

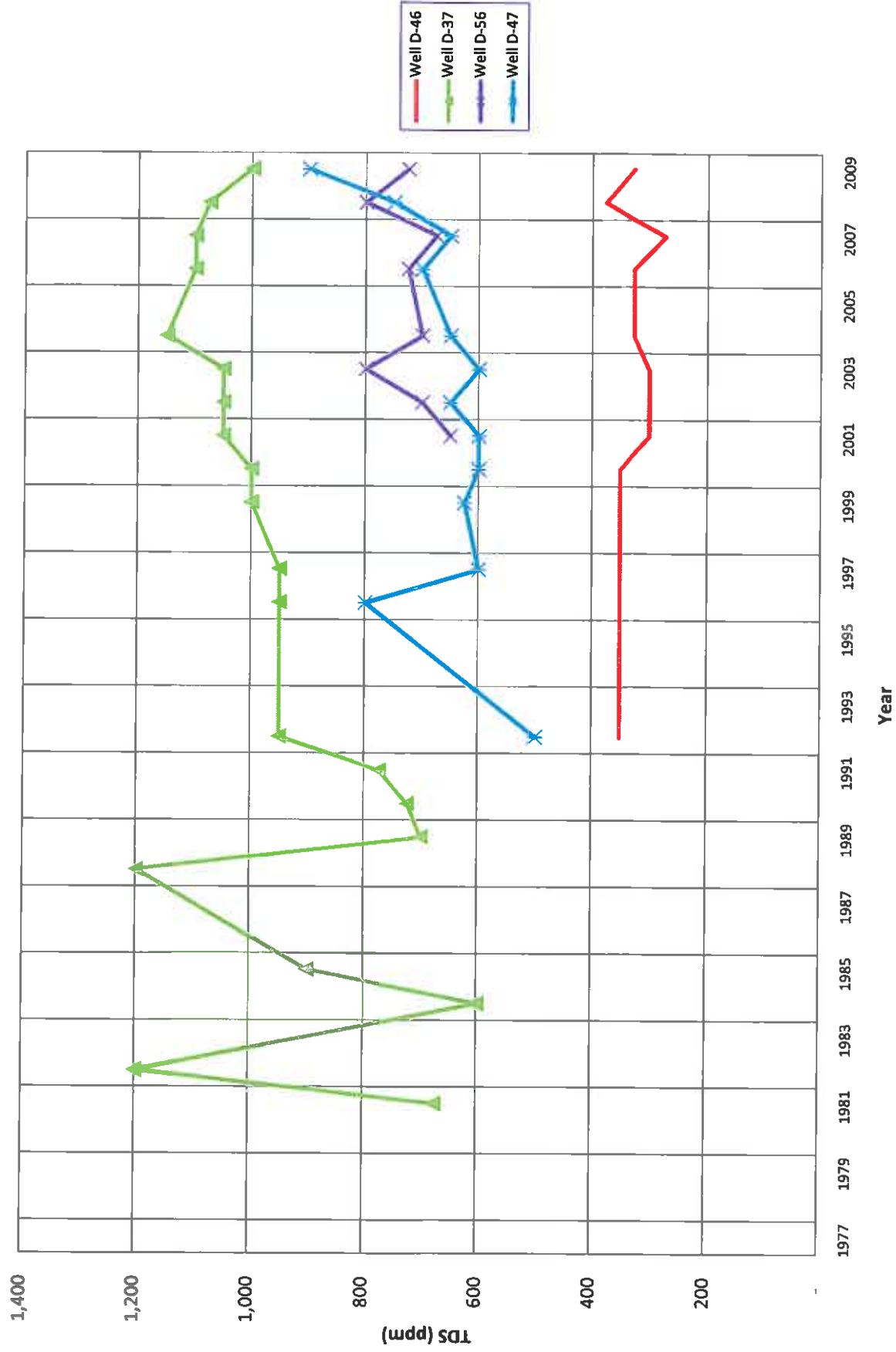
**JAMES IRRIGATION DISTRICT**

Local Groundwater Assistance Fund Grant  
Groundwater Quality Testing

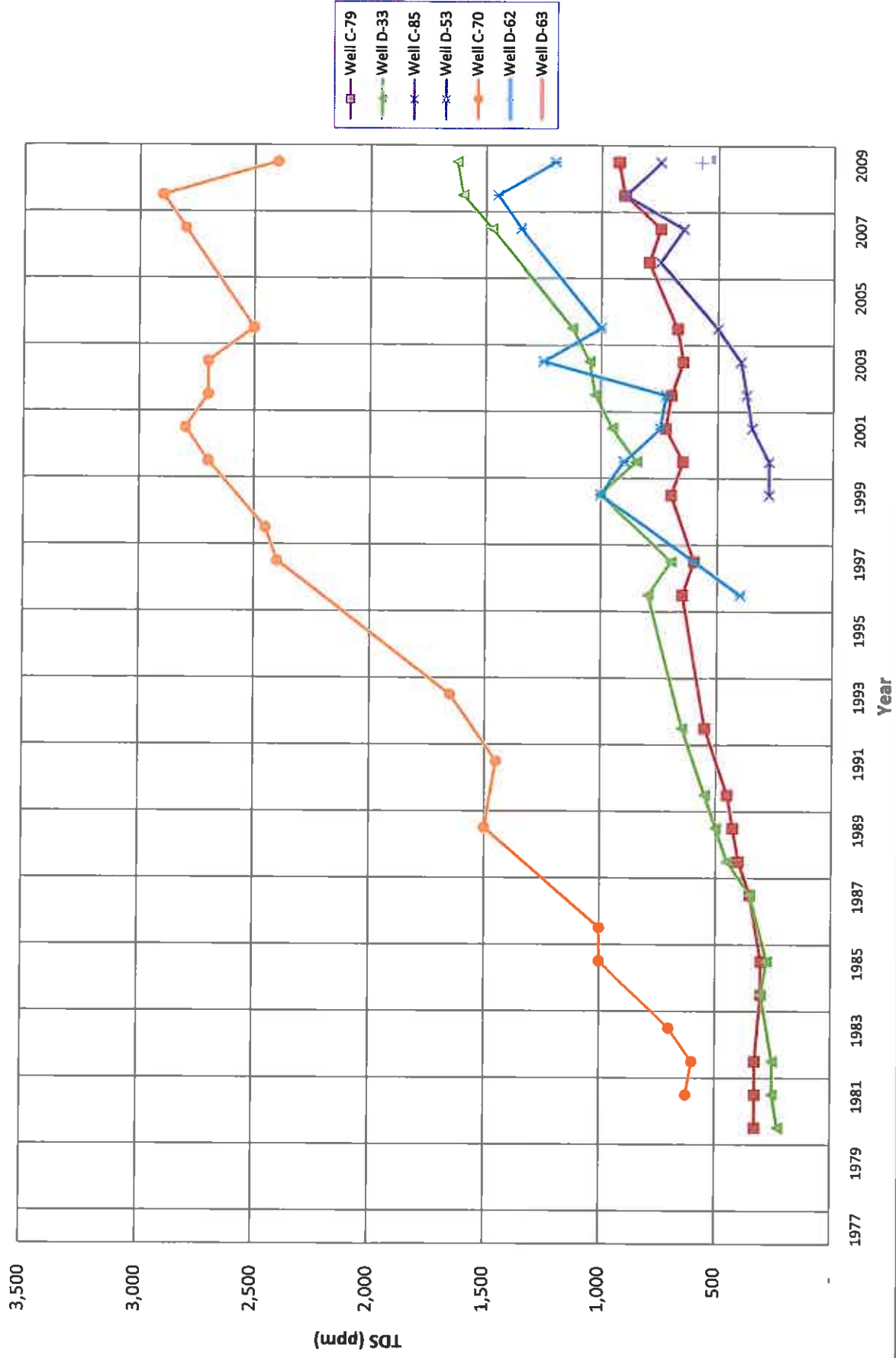
# James Irrigation District Groundwater Quality - Vicinity of Area A



# James Irrigation District Groundwater Quality - Area A

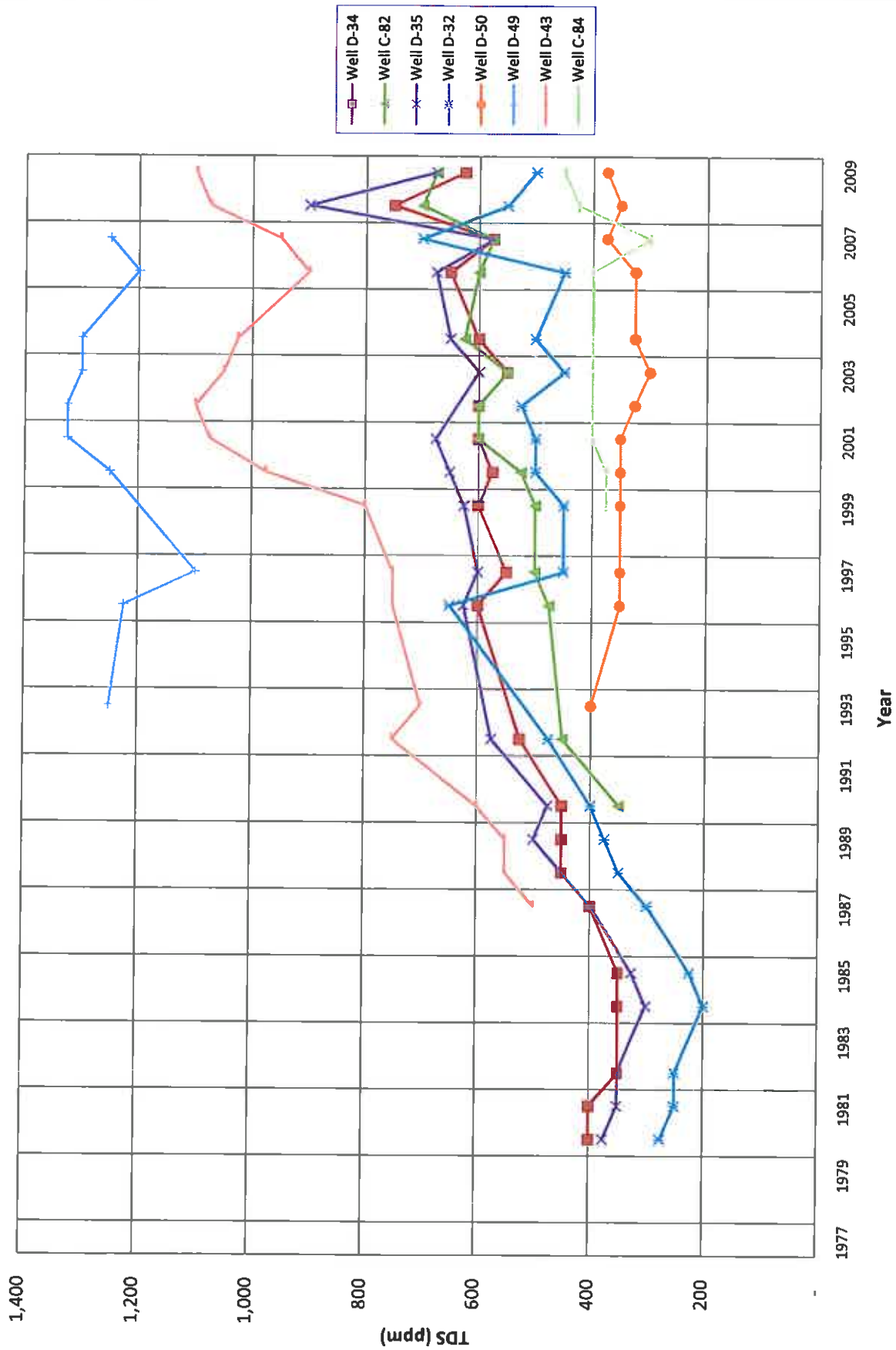


# James Irrigation District Groundwater Quality - Area B



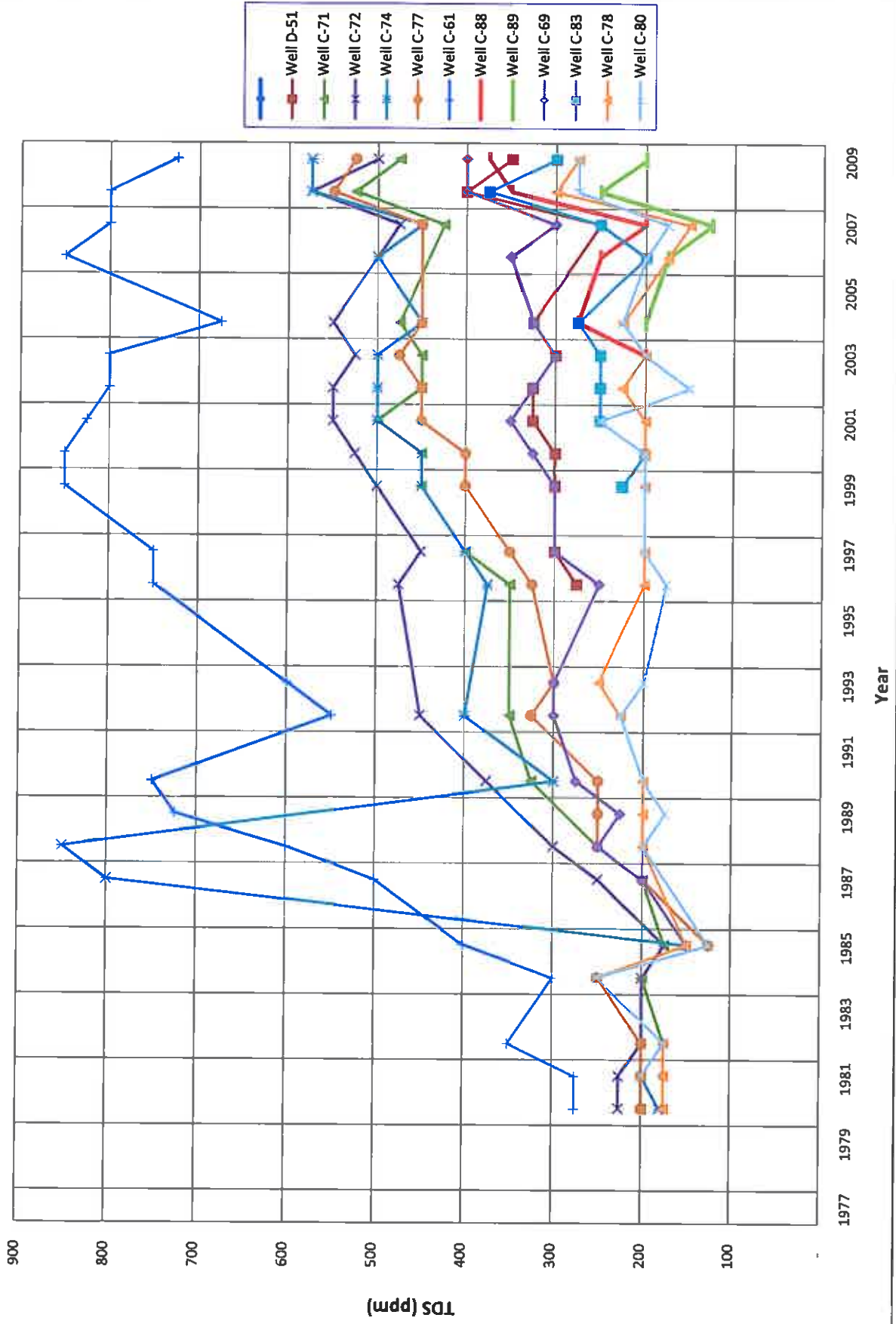


# James Irrigation District Groundwater Quality - West of Area B

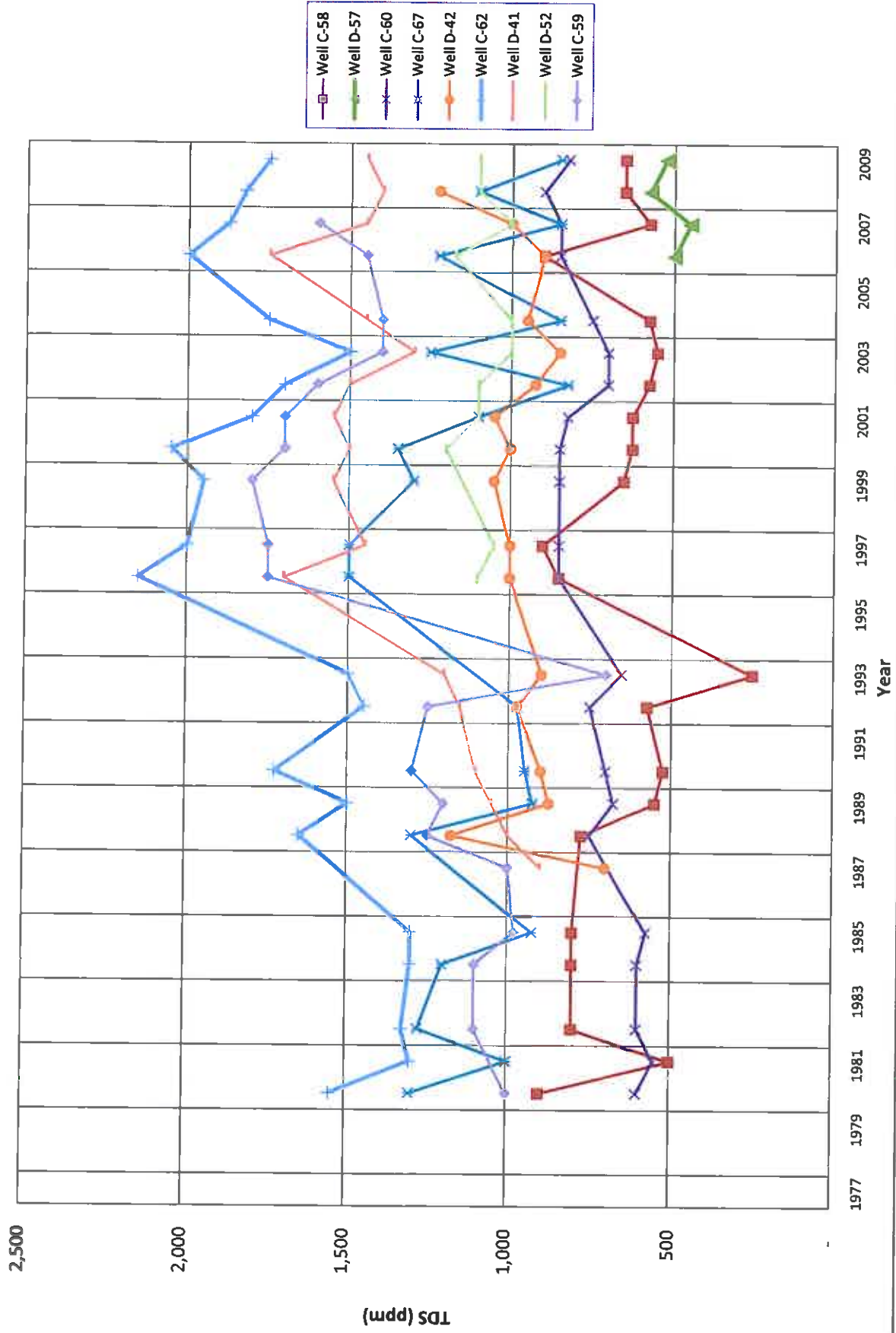




# James Irrigation District Groundwater Quality - East of Area B



# James Irrigation District Groundwater Quality - North of Area B



JAMES IRRIGATION DISTRICT  
CITY OF SAN JOAQUIN

GROUNDWATER MANAGEMENT PLAN

***APPENDIX G***  
***GROUNDWATER MONITORING PROTOCOLS***

## **GROUNDWATER MONITORING PROTOCOLS**

### **GENERAL SCOPE**

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The purpose of this document is to insure that the sampling and analytical methods are adequately documented and appropriate for the project scope and purpose by individuals responsible for implementing the monitoring program. Examples of all required forms are presented at the end of this section.

In general, measurements of the static water level will be taken from the top of each casing, and then the monitoring wells will be purged and sampled. A detailed description of these procedures follows.

### **EQUIPMENT USED DURING SAMPLING**

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Water level sounding equipment and field meter probes (pH, dissolved oxygen, conductivity, temperature, and turbidity) will be thoroughly rinsed with de-ionized/distilled water before and after each reading. All field meters will be calibrated according to manufacturer's guidelines and specifications before and after every day of field use.

The monitoring wells will be equipped with a dedicated sampling well pump or sampling activities will utilize disposable bailing equipment. All non-dedicated sampling equipment (in contact with sample) shall be thoroughly cleaned prior to each sampling event to prevent cross-contamination between samples and to ensure accurate representation of analytes of interest in each sample. All sample containers and sampling equipment shall be sterilized and transported to the field under conditions to preserve its sterility. Personnel performing decontamination shall wear gloves, eye-protection, and such other safety equipment as needed. The analytical laboratory as part of their agreement shall provide all sample containers, container preparation services, preservatives, and field blanks.

### **EQUIPMENT DECONTAMINATION PROCEDURES**

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All equipment that comes into contact with potentially contaminated water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. The following, to be carried out in sequence, is the recommended procedure.

- Non-phosphate detergent and tap water wash, using a brush if necessary;
- Tap water rinse; and

- Deionized/distilled water rinse.

## **WATER LEVEL MEASUREMENT PROCEDURES**

---

Water levels will be measured in wells that have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

If wellheads are accessible, all wells will be sounded for depth to water from top of casing and total well depth prior to purging. An electronic sounder, accurate to the nearest +/- 0.01-ft, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column, the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of the well screen. Total well depths will be measured by lowering the weighted probe to the bottom of the well and recording the depth to the nearest 0.1-ft. Depth to water and total well depth will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this section.

## **WELL PURGING**

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The wells will be sampled no sooner than 48 hours after well development. All wells will be purged prior to sampling. If the well casing volume is known, a minimum of three casing volumes of water will be purged using the dedicated well pump, if present, or a bailer, hand pump, or submersible pump depending on the diameter and configuration of the well. When a submersible pump is used for purging, clean flexible Teflon tubes will be used for groundwater extraction. Pumps will be placed 2 to 3 ft from the bottom of the well to permit reasonable draw down while preventing cascading conditions.

Water will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as  $V = \pi r^2 h 7.48$  where  $V$  is the volume of one well casing of water in gallons (1ft<sup>3</sup> = 7.48 gallons);  $\pi = 3.14$ ;  $r$  is the radius of the inner well casing (in ft); and  $h$  is the total height of the water column in the well (in ft).

It is most important to obtain a representative sample from the well. Stable water quality parameter field measurements (temperature, pH, and specific conductivity [EC]) indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- Temperature range is no more than +1/C;
- pH varies by no more than 0.2 pH units; and
- EC readings are within 10% of the average.

If the well casing volume is known, measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If the well casing volume is NOT known, measurements will be taken every 2.5 minutes after flow starts. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease, which will be noted in the field notes, and ground water samples will be taken. The depth to water, water quality field measurements, and purge volumes will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this section.

If a well dewateres during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and dewatered once more. After water levels have recharged to 80% of the static water column, groundwater samples will be collected.

### **WATER LEVEL MEASUREMENT AND WELL PURGING RECORDS**

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During the collection of each sample, the following information will be recorded on a Monitoring Well Purging and Sampling Record as presented at the end of this section:

- Well identification;
- Sampler's name(s);
- Date and time of sample collection;
- Designation of sample as composite or grab, if applicable;
- Type of sampling equipment used;
- Field instrument readings and calibration;
- Field observations and details related to analysis or integrity of samples (e.g., conditions in nearby waterways, weather conditions, noticeable odors, colors, etc.);
- Preliminary sample descriptions (e.g., clear with strong ammonia-like odor);
- Time of arrival/entry on site and time of site departure; and
- Deviations from sampling plans.

### **PURGED WATER DISPOSAL**

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Purged and excess groundwater collected for sample container filling may be disposed on site or in the sampling area by dispersing onto the ground, or at the owner's direction.



## **ANALYTICAL METHODS AND REPORTING LIMITS**

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Requested analytes are provided in the following table. Reporting limits are laboratory specific based on the type of equipment each laboratory uses. Analytical methods and holding times are listed by analyte below.

<b>Analyte</b>	<b>Standard Method</b>	<b>EPA Method</b>	<b>Holding Time</b>
PH	4500H-B	150.1	24 hours
EC	2510B	120.1	28 days
Alkalinity	2320B	310.1	14 days
Ammonium	4500NH4	350.1	28 days
Bicarbonate	2320B	310.1	14 days
Carbonate	2320B	310.1	14 days
Chloride	4500CI	300.0	28 days
Iron	3120B	200.7	6 months
Magnesium	3120B	200.7	6 months
Manganese	3120B	200.7	6 months
Nitrate as N	4500NO3	353.2; 300.0	48 hours
Nitrite as N	4500NO2	353.2; 300.0	48 hours
Phosphorus	4500P	365	28 days
Potassium	3120B	200.7	6 months
Sodium	3120B	200.7	6 months
Sulfate	4500SO4	300.0	28 days
TDS	2540C	160.1	7 days
TKN	4500-NH3	351	28 days

## **SAMPLE CONTAINERS AND PRESERVATIVES**

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Sample containers are generally available directly from the laboratory. All containers will be one-liter polyethylene, precleaned, and analyte specific. Groundwater samples for TKN and ammonia will be collected in containers containing H<sub>2</sub>SO<sub>4</sub> as a preservative. The remaining samples need not be preserved. If a preservative is present, the bottle will be capped and lightly shaken to mix in the preservative. Samples from each location that require the same preservative may be placed in the same bottle if being analyzed by the same laboratory. Samples to be analyzed for dissolved metals must be filtered prior to preservation and analysis.

## **SAMPLING PROCEDURES**

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Water samples will be collected from each well and placed into laboratory prepared containers, sealed with tight fitting caps, labeled, and stored in a cool ice chest. Water



used for field measurements of temperature, pH, and EC shall not be used as sample water. The following are the recommended sample collection procedures:

- Rinse the tubing with one liter of sample prior to sample collection;
- If no preservative is present, rinse sample bottles three times with a small amount of sample;
- Collect sample directly into the sample bottle;
- Allow sample containers to be open for the shortest time possible to prevent contamination;
- Do not touch the inside of bottles, lids, or tubes. Hold the bottle lid with the inside facing down to prevent contaminating the inside of the lid;
- Allow the sample water to flow into the bottle from above;
- Close bottle tightly,
- Samples will be chilled to 4 C° immediately upon collection; and
- Transport samples to the lab as soon as possible.

At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. If a duplicate sample is to be collected at this location, all bottles designated for a particular analysis will be filled sequentially before bottles for another analysis are filled.

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. Every sample, including samples collected from a single location but going to separate laboratories, will be pre-assigned an identifiable, unique sample number. The following is an example sample label:

<b>Sample #:</b>	<b>Well ID:</b>
<b>Analytes:</b>	<b>Date:</b>
<b>Collected by:</b>	<b>Time:</b>

It will be possible to identify each unique sample by recording the following information on the Monitoring Well Purging and Sampling Record:

- Sample identification numbers and any explanatory codes;
- Sample date and time;
- Lot numbers of the sample containers;
- Chain-of-custody form numbers;
- Shipping arrangements (overnight air bill number); and
- Name(s) of recipient laboratory (ies).

## **CHAIN-OF-CUSTODY**

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A chain-of-custody (COC) record will be completed and accompany all sample shipments for each laboratory and each shipment. If multiple coolers are sent to a

single laboratory on a single day, COCs will be completed and sent with the samples for each cooler. Generally, the laboratory will supply blank COCs. An example COC is included at the end of this section.

The COC will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. The sampling team leader or designee will sign the COC in the "relinquished by" box and note date, time, and air bill number.

## **SAMPLE HANDLING AND TRANSPORT**

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The following outlines the packaging procedures for sample delivery to a California Certified Environmental Laboratory Accreditation Program (ELAP) laboratory:

- Pack ice in zip-locked, double plastic bags. Seal the drain plug of the cooler with tape to prevent melting ice from leaking out;
- Line the bottom of the cooler with bubble wrap to prevent breakage during shipment;
- Check screw caps for tightness;
- Seal all container tops with tape;
- Secure sample labels onto the containers with clear tape;
- Wrap all glass sample containers in bubble wrap to prevent breakage;
- Seal all sample containers in heavy-duty plastic zip-lock bags with the sample numbers written on the outside of the bags with indelible ink;
- Place samples in a sturdy cooler(s) lined with a large plastic trash bag. Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid;
- Fill empty space in the cooler with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment;
- Double seal ice in two ziplock plastic bags and place on top and around the samples;
- Secure each ice chest with strapping tape; and
- Secure address and shipping labels to cooler.

**Monitoring Well Purging and Sampling Record**

Client:	_____	Date:	_____
Project Name:	_____	County:	_____
Project Address:	_____		
Project Manager:	_____	Job No:	_____
Regulatory Contact:	_____	Phase(s):	_____
Sample Containers:	_____	Telephone:	_____
Preservatives:	_____	Air Temp (F):	_____
Instrumentation:	_____	Precipitation:	_____
Date Last Calibrated/By:	_____	Wind (dir/speed):	_____
		Sampler Signature:	_____

Well Number						
Well Elevation (ft)						
Well Diameter (in)						
Slotted Interval (ft)						
DTW (ft)						
GW Elevation (ft)						
Sounding Depth (ft)						
Well Volumes (gal)						
Notes:						
<b>Well Volume Purged (1<sup>st</sup>)</b>						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
<b>Well Volume Purged (2nd)</b>						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
<b>Well Volume Purged (3rd)</b>						
Time						
Temp (C°)						
pH						
EC						
Volume Removed (gal)						
Sample Depth (ft)						
Sample Time						

**Equipment used:****Remarks:**

2" Well Volume = 0.163 x height of water column

4" Well Volume = 0.653 x height of water column